The policy and regulatory context for new Local Energy Markets

ERIS Elective

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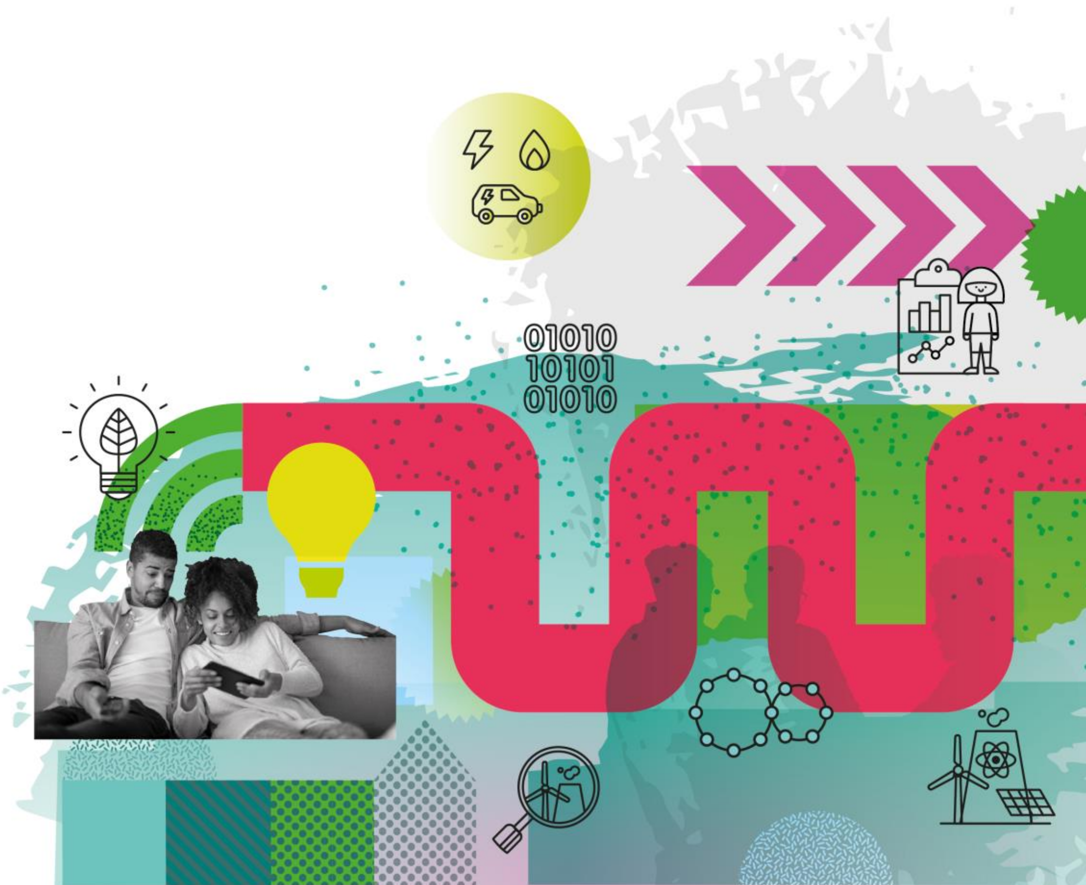
September 2019



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Context

This report has been prepared by Energy Systems Catapult - Markets, and Policy and Regulation team, on behalf of the ERIS programme.

The purpose is to provide a review of how the near and medium-term policy and regulatory future might evolve for local energy markets, to help the Prospering from the Energy Revolution (PFER) project consortia understand some of the potential risks and benefits associated with their concepts.

Based on the commonalities identified through engagement between the projects and the ERIS team, it was decided to focus this review on the electricity networks and markets in Great Britain to provide widest benefit. Focus was placed on issues relating to the connection of additional generation and storage assets and the facilitation of demand-side response in constrained network areas.

The report has been written primarily for the concept project participants based in Great Britain, however, may also be of interest to those involved more widely in the PFER programme, including the Demonstrator projects, EnergyREV, and in future, the Detailed Design projects.

There is potential in future, for ERIS to extend this type of policy and regulatory review to other areas relevant to Smart Local Energy Systems such as gas, transport and heat sectors, other aspects of electricity markets, as well as different markets (e.g. NI). The ERIS team welcome any feedback from project members relating to either this report, or future focus areas participants would like included. Please send any suggestions to eris@es.catapult.org.uk.

1. Executive summary

Local Energy Markets (LEMs) are emerging in Great Britain as a potential solution to coordinate an increasingly complex decentralised energy system. They serve as instruments to coordinate the generation, supply, storage, transport, and consumption of energy from decentralised energy resources (DER) within a confined geographical area. Local energy market concepts are still in the initial stages of development and vary with respect to design and functionality, including:

- the attribute being traded (e.g. energy or flexibility);
- the market participants involved (e.g. distribution system operator (DSO), electricity system operator (ESO), prosumers) and the role they play (e.g. buyers, sellers, facilitators);
- the type of market signals and the extent of control of assets exercised through market mechanisms (e.g. aggregation, local energy management, etc.).

The value of different arrangements is yet to be tested and evaluated. Ongoing trials and the outcome of other changes in the electricity system (e.g. the changing role of distribution network operators (DNOs)) will have a profound impact on the costs and benefits of different LEM arrangements.

Benefits and Risks

Potential **benefits** of establishing a LEM include:

- improving network management (including system balancing);
- providing an alternative route to market and income generation for local generation, storage and demand-side response (DSR);
- supporting community energy projects which can reduce energy costs for their users.

There are also potential **risks** such as:

- unintended consequences on wider system users – e.g. increasing energy and network costs for parties not connected to the LEM;
- making system balancing harder for network operators if local actions are not coordinated and there is limited platform interoperability and integration with other markets.

Appropriate market design and stakeholder engagement is essential to identify and manage these risks, ensuring that the potential benefits of LEM are fully realised. Market signals upon which LEMs are based should reflect the value of local generation, storage and demand side response to the system.

Policy and regulatory developments

Significant policy and regulatory changes are currently underway across the electricity sector. They are likely to impact LEM developments, placing constraints on what arrangements are feasible and what resources might be available on the system in future. Key areas of reform that may affect the potential for LEMs, include:

- **Distribution Network Operator (DNO)/ Distribution System Operator (DSO) transformation process –** a potential future change in the role and responsibilities of DNOs would modify the interactions between actors at the transmission and distribution network level. Such change is likely to have a positive impact on LEM development by creating a new market and demand for local flexibility. The process is ongoing, and the precise role of future DSO organisations remains uncertain at present.

- **Half-hourly market settlement reform** will enable the development of more accurate pricing signals across the electricity system, including at local level. This reform could also support the development of LEMs, due to its potential to maximise the use of local energy resources for local balancing services (e.g. providing stronger price signals for use of local renewable generation when it is abundant).
- **Review of retail supply and the supplier hub model –** the existing model prevents the establishment of alternative market arrangements as many essential functions in the UK energy market (e.g. balancing, settlement, billing, etc.) are strictly attributed to a single licensed party. A reform of the existing retail supply model would likely increase competition by opening-up market arrangements for new business models and to more actors, including those at local level.
- **Changes in network charging –** significant changes in the calculation and allocation of network charges, including aspects of locational price signalling, could lead to complexity in forecasting future price signals at local level but can also unlock value at local level and potentially create new markets for network capacity, which an LEM could leverage and benefit from.
- **Future governmental support for energy investments –** uncertainty in future policy to support small-scale renewable generation (e.g. the Smart Export Guarantee), and other DSR and generation/storage technologies, could have a detrimental impact on the investment case for local assets, potentially affecting LEM liquidity and market prices.

Key points for consideration for LEM designs

In the context of these wider system developments, it is important for LEM designs to consider the following key questions:

- **Interoperability** with future DSO/ESO platforms: in light of potential future changes to the way the electricity system is operated, LEMs would need to have technical capabilities that enable them to "speak" not only to existing platforms (ESO), but also to potential future platforms (if DSOs emerge as new actors at distribution network level). This would allow LEMs to provide access to multiple value streams across the electricity system.
  - ➢ **What are the technical requirements for the LEM platform?**

- **Smart meters** and responsive tariffs could be key to enable price signals to reach local platform users and unlock local supply and demand for energy. Smart meters would also be required for data collection at half hourly periods (which will likely be required for settlement purposes in future).
  - ➢ **How do you ensure smart meters are rolled out across all platform users?**

- **Consumer protection** mechanisms may need to be established at LEMs.
  - ➢ **How would individual data be managed in line with data protection requirements?**

- **Establishing balancing and settlement** process within LEMs would be crucial to provide security for market participants. Consideration around how the LEMs would interact with system-wide settlement processes and requirements are also key.
  - ➢ **How would the balancing and settlement processes work in an LEM and how would boundary interactions be defined?**
  - ➢ **What data needs to be provided so participants can meet industry requirements for balancing and settlement purposes?**

- **Revenue stacking**: LEM participants would likely benefit from accessing multiple revenue streams, thus enhancing the viability of their business models.
  - ➢ **How can access to multiple revenue streams by LEM participants be enabled?**

- **Managing conflicts** in market demands/ signals: with potential multiple purchasers of energy and flexibility services in future, conflicting requests could arise and would need to be managed.
  - ➢ **How could the design of an LEM prevent conflicts in contracting for services?**

- **Future reforms to forward-looking network charges and network access** could alter the final price signals end users are exposed to. These interactions need to be carefully assessed when evaluating the business case for LEMs. Options to enable secondary trade in network capacity rights might also mean that a new market becomes available, potentially impacting import/export decisions for asset owners.
    - **Will the change in network access charges have an impact on revenue for LEM participants (e.g. aggregator business models) and/ or reduce benefits for its end users (e.g. local energy customers)?**
    - **If reforms result in enabling a secondary market for trade in capacity rights, would that market be considered part of a combined LEM design (enabling simultaneous trade in energy and capacity)?**
    - **Have LEMs engaged with local stakeholders to understand how network reforms (e.g. changes to the way residual network charges are levied) might impact the business plans of potential market/platform users?**

- **LEMs as point of contact to customers:** a reform on the role of suppliers as a single point of contact for end customers is foreseen but remains highly uncertain. Several code modifications are underway, which if implemented, would enable multiple supplier to deliver energy to a single user, but they too remain highly uncertain. It is likely that if LEMs enabled direct trade between end users, they would need to act in line with existing industry rules (e.g. operate through via a licence).
    - **How would LEMs contract with customers in the short term to enable trade between them (e.g. through a licencing arrangement, a partnership with licenced suppliers…)?**

- **Interactions with renewable energy incentives**: Since existing governmental support schemes are considered a form of state aid, and rules exclude recipients from receiving other revenue while receiving payments (e.g. FiTs, CfDs), resource providers in LEMs would likely need to opt out of alternative payments. In future, the Smart Export Guarantee is expected to replace existing schemes and would offer a competing source of revenue for local resources by directly creating a route to market for them in national markets.
    - **How would interactions with existing and proposed renewable energy schemes impact the number of participating resources in a LEM?**

2. Introduction

Electricity markets have been historically designed to reflect the 'conventional' centralised configuration of the system, relying on large-scale, transmission-connected generation assets and one-way power flows from generation to supply. The move towards increasingly decentralised, distributed generation assets poses challenges for the existing governance, regulatory, and commercial structures. In the UK and elsewhere in Europe, local energy markets are emerging as one solution to the issue of coordinating this increasingly complex system.

The purpose of this report is to provide an overview of how current and future regulatory and policy arrangements are likely to impact, and be impacted by, Local Energy Market (LEM) development in the UK. It is structured as follows:

- **Chapter 3** highlights the existing market, policy and regulation arrangements and how they function to support and constrain the use of distributed energy sources.
- **Chapter 4** discusses the role and design of LEMs.
- **Chapter 5** provides an overview of medium-term policy and regulatory arrangements and evaluates their likely interaction with and impact on LEMs. It covers:
    - developments in DNO/DSO transformation;
    - settlement reforms;
    - network charging reforms;
    - future retail policy changes; and
    - governmental renewable energy schemes.
- **Chapter 6** concludes with recommendations on how to stay informed and engage with ongoing policy and regulation processes.

3. Existing market, policy and regulation arrangements

3.1. High-level overview of regulatory framework

The UK electricity sector operates under a competitive wholesale and retail market, combined with a framework of regulated price controls for network companies. Different market and non-market-based mechanisms combine to send price signals to system users. The market environment is also heavily influenced by governmental policy aimed at achieving decarbonisation and security of supply (e.g. through mechanisms like the Capacity Market and Contracts for Difference (CfD)) as well as ensuring that energy prices are affordable for consumes. Table 1 provides a high-level overview of current institutional arrangements and key stakeholders involved in the electricity industry.

Table 1: Overview of key institutional arrangements and roles in the UK electricity sector

Role	Institutions	Main Responsibilities
Sector regulator	• Ofgem	• Monopoly price controls • Licencing • Consumer protection • Ensuring competition • Enforcement
Setting policy direction	• Government and Devolved Administrations (incl. Department for Business Energy and Industrial Strategy (BEIS))	• Setting national policy for energy infrastructure • Decisions on support schemes for generation technologies (e.g. FiTs) • Decisions on schemes for security of supply (Capacity Market) • Decisions on schemes to safeguard affordability/ fuel poverty
Transmission Owners (TOs)	• National Grid Electricity Transmission (England and Wales) • Scottish Power Transmission Limited and Scottish Hydro Electric Transmission (Scotland) • Independent offshore transmission owners (offshore wind connections) • Interconnectors	• Investment and maintenance of transmission assets • Engagement in network planning and connection
Distribution Network Operators (DNOs)	• 14 main regional distribution network operators • Independent network owners (residential/business areas) • Private networks (private use, unregulated)	• Investment and maintenance of distribution assets • Engagement in network planning and connection
Electricity System Operator (ESO)	• National Grid ESO (a separate company to National Grid from April 2019)	• Real time system operation/balancing

		• Managing the Balancing Mechanism (BM) and ancillary services market • Support network planning with future electricity demand and supply assessments
Retailers/suppliers	• A series of small, medium and large-scale companies	• Point of contact for end users • Estimate customers electricity usage • Purchase electricity for customers • Responsible for metering and balancing[1] • Utilised for recovery of cost of governmental support schemes
Electricity generators	• A series of small, medium and large-scale companies • Traditionally large transmission-connected fossil-fuel based generation. Increasingly distribution level renewable generation	• Electricity generation • Offering electricity balancing and ancillary services (resource dependent)
Balancing and Settlement Code Administrator	• Elexon	• Aggregating settlement positions submitted by participants • Calculating settlement positions for market participants

3.2. Industry codes and governance

Since the generation, supply, and distribution of electricity are all regulated activities, participants would generally need to acquire a license in order to be able to operate. Separate licences govern supply, generation, distribution and transmission network ownership, and interconnection.[2]

There are several industry codes that electricity sector participants need to comply with, summarised in Table 3. As industry rulebooks, they place obligations on participants and prescribe how participants interact with the system. Table 3 maps the obligations that the codes create for different users depending on their assumed role in the system. Under current arrangements,

[1] Suppliers are responsible for the settlement of their energy imbalance volumes i.e. the difference between commercially contracted volumes (purchased based on estimated energy consumption) and metered volumes (actual energy consumption).

[2] In limited circumstances exemptions might be granted for electricity generation, distribution or supply licence – they generally cover small and on-site operations. Arrangements are set out in the *Electricity (Class Exemptions from the Requirement for a Licence) Order 2001*. Available from: http://www.legislation.gov.uk/uksi/2001/3270/contents/made

demand-side response is not a separately licensed activity, and DSR aggregation is not subject to network code requirements. A voluntary code of conduct for DSR aggregators is in place[3].

Table 2: Overview of industry codes and standards in the UK[4]

Electricity Network Code	**Description**
Distribution Code (D-Code)	Sets out technical rules for planning and use of electricity distribution networks
Distribution, Connection and Use of System Agreement (DCUSA)	Sets commercial rules for the use of distribution networks
Grid Code	The technical details for the connections, operation and use of electricity transmission networks
Connection and Use of System Code (CUSC)	The contractual framework for connection and use of the transmission system
System Operator/ Transmission Code (STC)	Defines the relationship between the ESO (National Grid) and transmission operators
Master Registration Agreement (MRA)	The rules for the retail market processes, notably Metering Point Administration Services provision and the process of consumers switching suppliers
Balancing and Settlement Code (BSC)	The rules for participating in the balancing mechanism and for settling electricity imbalance
Smart Energy Code (SEC)	The rules for any party involved in smart meter management

Table 3: Map of licenses and network code compliance requirements under standard licence conditions

Participants	**Associated Codes**							
	D- Code	DCUSA	CUSC	Grid Code	STC	BSC	MRA	SEC
Transmission Operators (TOs)					✓	✓		
Distribution Network Operators (DNOs)	✓	✓	✓	✓		✓	✓	
Interconnectors	✓		✓	✓		✓		
Transmission and distribution connected	✓	✓	✓	✓		✓		

[3] For more information visit the Association for Decentralised Energy (ADE)'s website: https://www.theade.co.uk/news/press-releases/new-flex-assure-scheme-to-help-businesses-trust-and-benefit-from-smart-ener

[4] Lockwood, M., et al. (2015). Innovation and energy industry codes in Great Britain. EPG Working Paper 1508. Available from: http://projects.exeter.ac.uk/igov/wp-content/uploads/2015/12/ML-Innovation-energy-industry-codes-in-GB1.pdf

generation above certain size[5]								
Suppliers	✓	✓	✓			✓	✓	✓

3.3. Participation for distributed energy sources in existing markets

Opportunities for flexibility providers (demand-side response, distributed generation or storage) exist in most national markets, however, these are relatively limited due to technical constraints and significant administrative and commercial requirements (e.g. minimum bid size, volume, delivery requirements). Current electricity market arrangements in the UK comprise of:

- **Wholesale electricity market** – dominated by bilateral trades, with some room for participation via independent exchange platforms (e.g. EPEX, Nordpool).
- Centralised **ancillary services** and **balancing mechanism** – run by an independent Electricity System Operator (ESO), used for the purpose of short-term system operation, constraint management, security of supply assurance.
- Government support schemes for specific technologies e.g.:
  - **Capacity market** (currently suspended);
  - **Contracts-for-Difference (CfDs)** (currently only open to offshore wind installations);
  - **Feed-in-Tariffs (FiTs)** (suspended).

Table 4 highlights the existing rules for participation and the current direction of policy change across these markets. Since different markets require different set of capabilities, resource providers might be able to capture variable value streams. The value realised by specific projects would depend on the specific business models adopted.

Table 4: Summary of existing market arrangements for small-scale generation, storage and DSR sources and key directions for policy change

	Market/Service type	**Demand side reduction/ load shifting**	**Energy storage**	**Distributed generation**	**Direction of policy change**
Wholesale market	Bilateral trading.	-	There are no direct barriers to bilateral trade agreements.		Market-wide half-hourly settlement reform in progress, enabling more accurate price signals to reach end users.
	Power exchange trading.		Subject to minimum bid size requirements – e.g. 0.1MW (EPEX Spot, NordPool).		
Ancillary service	**Short term operating reserve (STOR)** Active power from generation or demand reduction. Three tender rounds per year. Seasonal contracts; up to 2 years in length.	**Minimum 3 MW**; can be aggregated. Response requirement – within max 240 minutes (20 mins preferable). Sustain requirement – sustain for min 120 minutes; recovery period not more than 1200 minutes.			Transition smaller scale (non-BM) STOR providers to a new IT system to enable efficient dispatch.

[5] See Annex 3 for details

<table>
<tr><td></td><td>Fast reserve
Active power from generation or demand reduction.
Procured through monthly tenders.</td><td colspan="3">Minimum 25 MW (from March 2019)
Delivery must start within 2 mins of dispatch instruction.
Response – delivery rate in excess of 25 MW/min.
Sustain – reserve energy sustained for min 15 mins; able to deliver min 25 MW.</td><td>New IT systems for dispatching smaller-scale (non-BM) Fast Reserve providers.</td></tr>
<tr><td></td><td>Demand Turn Up
Large energy users and generators at times of high renewables output and low demand.</td><td colspan="3">Minimum 1 MW; can be aggregated from sites of at least 0.1 MW
Average response time and duration - average notice period (2017) - 6 hours 40 minutes. Average length of delivery - 3 hours 34 minutes.
Equipment - minute by minute or half hourly metering required.</td><td>Designed for near-term (not viewed as lasting "negative" reserve solution)
All reserve services to be reviewed in 2019 as part of National Grid ESO's work to reform Balancing Services.</td></tr>
<tr><td></td><td>Firm Frequency Response (FFR)
Generation and demand;
Monthly tenders.</td><td colspan="3">Minimum 1 MW (single unit or aggregated)
Response – within 2–30 seconds (depending on service time).
Dynamic frequency – continuous (via operation in frequency sensitive mode).
Static frequency – upon instruction (via automatic relay).
Dispatch – single point of dispatch or method to provide monitoring for ESO needed.</td><td>Trialling weekly auctions.</td></tr>
<tr><td>Balancing Mechanism</td><td>Operated by National Grid to balance the electricity network after gate closure.</td><td colspan="3">Minimum 1MW (single unit or aggregated)
Following implementation of Project TERRE, aggregators will be able to bid units without needing a supply licence.
DSR is currently engaged through bilateral contracts with National Grid, following testing and verification.</td><td>Widening access;
Project TERRE[6]
National Grid's Distributed Resource Desk.</td></tr>
<tr><td>Capacity market</td><td>Capacity auctions focused on security of supply.
Open to new and existing generation and DSR, with different contract lengths.</td><td>Able to participate; subject to verification procedures.</td><td>De-rating factors depending on type of asset (e.g. battery duration</td><td>Open for participation for DER, except renewables in receipt of other</td><td>Currently suspended

De-rating methodology allowing renewables</td></tr>
</table>

[6] Project TERRE allows distributed generation, aggregators, and consumers to register and participate directly in the balancing mechanism. The project was implemented through the BSC modification in February 2019. For more information see: https://www.elexon.co.uk/mod-proposal/p344/

			and capacity).	governmental support (i.e. CfD, FiTs or Renewable Obligations (ROs)).	developed to allow participation following end of other support contracts.

3.4. Constraint networks and network management

Currently, electricity networks are planned and designed to meet peak demand or peak generation requirements[7]. Traditionally, if new requests for network connection were expected to result in violation of peak demand or generation limits this would create a need for network reinforcement, the cost of which is partially recovered from connecting network users.

More recently, distribution network companies have started offering flexible connections (known as non-firm connections), constrained connections or active network management schemes to support the introduction of generation, demand or storage assets in constrained network areas. These schemes enable an asset to connect to the network prior to or without network reinforcement in areas where network capacity constraints might have been otherwise violated. ***New customers agree to be temporarily restricted from accessing the network in times when peak network capacity is reached, in exchange for possible reduction in connection waiting time and/or cost.*** The potential benefits for new generation or demand connections stem from changes in required investment on the distribution or transmission system needed to accommodate them. What kind of benefit is realised by projects accepting a non-firm connection is usually project specific, but depends on the kind of network asset investment that is being avoided or shifted[8]:

- Where the network asset is for sole use, flexible connections can lead to cost, but not necessarily lead time reduction.
- Where the connection requires deep network reinforcement, a flexible connection can lead to lead time reduction, but not necessarily cost savings.
- Where the network assets are shared, both lead time and cost benefits can be realised.

The main risks of accepting a flexible connection are linked to:

1. Possibility for frequency and degree of future output/input restrictions to change over time as network demands change with actions of other users.
2. Uncertainty in the future state of network if a customer decides to switch from a flexible to standard connection at a later stage.

Such unpredictability makes it difficult for project developers to appropriately price flexible connection contracts. Where multiple projects connect to the same network area, the basis on which output changes are determined can impact risk allocation. Some output reduction methodologies (e.g. Last-in-First-Out curtailment) might offer a higher degree of predictability for

[7] For further information see Energy Networks Association's website: http://www.energynetworks.org/electricity/futures/flexible-connections.html
[8] Northern Powergrid (2015) Flexible Connections Offered. http://www.energynetworks.org/assets/files/electricity/futures/Flexible%20Connections/NPg%20Flexible%20Connections%20Offered%20December%202015%20v1.0.pdf

individual project developers, while others (e.g. rotational curtailment rules) can facilitate a greater number of connections but also carry higher individual project risk.[9] Choices by DNOs about which methodology to rely on might therefore impact the outlook of assets in a specific geographical area. The types of contracts users can select depends on their location and the types of connections offered by the relevant DNO in that area.

When it comes to market-based purchases of flexibility, to date DNOs have concentrated on procurement in specific network constrained locations. Procurement processes are in trial phases or early stages of development and are highly context-dependent; the value of providing local flexibility to DNOs remains unknown at present. An indicative benchmark estimate by Western Power Distribution places this value at around £35 - 50k/MW/year, depending on the flexibility service, location and individual DNO[10].

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[9] Andoni, M., Robu, V. and Früh, W.G. (2016) Game-theoretic Modelling of Curtailment Rules and their Effect on Transmission Line Investments. Available from: https://doi.org/10.1016/j.apenergy.2017.05.035
[10] Regen, Carbon Co-op (2018). Energy Community Aggregator Services (ECAS) feasibility study, Available from: https://cc-site-media.s3.amazonaws.com/uploads/2019/01/ECAS-Local-Flexibility-Markets.pdf

4. Understanding local energy

4.1. Local energy and local markets

With the growth of distributed generation, multiple business models have been developed that are aimed at utilising "local" sources or supplying "local" communities. They rely on the provision of local supply or generation, development of targeted local consumer services (e.g. energy efficiency improvement schemes), and the utilisation of specific areas on energy networks (see Table 5). Emerging models also extend to new assets connecting to local networks, including control and management of electric vehicle charging infrastructure and battery storage utilisation.

Table 5 Example emerging local energy service models[11]

Local energy archetype	Examples
Local consumer services	• Energy advice schemes • Energy efficiency schemes • Fuel poverty schemes • Energy Service Company (ESCO).
Local Generation	Local generation assets (e.g. rooftop solar farms) owned and/ or managed by the community for local use.
Local Supply	Business models aimed at supplying local communities (e.g. city council-owned suppliers).
Micro-grid	Decentralised grid operating in parallel to or independent of the national grid (both grid-connected and off-grid).
Virtual private networks	Trial projects that introduce new market arrangements for local balancing purposes, but still operate via the public distribution network.

The coordination of decentralised energy supply, storage, transport, conversion and consumption within a given (local) geographical area, known as local energy management, is still a developing topic and the precise nature and organisation of these interactions can vary significantly[12].

In the UK[13], "local energy markets" are emerging as a new method for local asset coordination, with Cornwall Local Energy Market becoming one of the most prominent operational examples so far[14]. The distinguishing feature of local energy markets is that on the side of asset provision they are only open for participation for resources within a specific local area – distributed generators,

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[11] Ofgem (2017). Future Insights Series Local Energy in a Transforming Energy System. Available from: https://www.ofgem.gov.uk/system/files/docs/2017/01/ofgem_future_insights_series_3_local_energy_final_300117.pdf

[12] Eid, L. et. al. (2016) Market integration of local energy systems: Is local energy management compatible with European regulation for retail competition? *Energy*, 114, pp. 913-922. Available from: https://doi.org/10.1016/j.energy.2016.08.072

[13] Northern Ireland and the Republic of Ireland operate a separate wholesale electricity market across the island known as the Single Electricity Market (SEM). They are subject to separate regulation.

[14] See project website: https://www.centrica.com/innovation/cornwall-local-energy-market

storage and DSR providers. These resources can sell their energy or services either entirely locally (e.g. in peer-to-peer trading or to local distribution network companies) or be aggregated and sold further in national-level markets. The source of revenue available to local assets via the marketplace depends on the design of the local market platform and how it interacts with actors in the wider system. Local marketplaces can be designed to enable access for con/prosumers, aggregators, suppliers, ESOs and distribution networks owners and allow the trade of both energy and flexibility between local resource providers and other users.

Settlement of transactions within the local market, between different local markets that might emerge and between the local market and the existing national markets (e.g. wholesale, balancing mechanism) will pose challenges from both an operational and policy and regulatory point of view. The establishment of new processes for reconciling and settling transactions at multiple levels between markets is a key issue that should be considered an early LEM design stage.

4.1.1. Key features/design aspects

Local market arrangements can either facilitate energy exchanges between prosumers within a locality (i.e. community engagement via peer-to-peer trading) or facilitate the provision of flexibility – either for local portfolio balancing services or network management services.

Table 6 summarises some of the key design features that define a local marketplace.

Table 6: Key differentiating local market features

Feature	Options
What is traded	Flexibility (change in energy generation or consumption) [15] Energy (kWhs) Network capacity (in future)
Market function	Network management – purchasing local energy services with the aim of reducing network management costs, or avoiding/deferring network capacity investment Local portfolio balancing – using local energy marketplace to hedge short-term variation in generation/supply for small-scale asset owners Local trade – enabling local energy exchange
Procurers	ESO, DSO (buying flexibility), aggregators, suppliers (buying energy for local portfolio balancing; local energy supply)
Sellers	Local generation and storage asset owners Community/domestic prosumers (small-scale generation, Storage, DSR) Large energy users

[15] Ofgem defines flexibility as “modifying generation and/or consumption patterns in reaction to an external signal (such as a change in price) to provide a service within the energy system”. Ofgem (2019) Electricity system flexibility. Available from: https://www.ofgem.gov.uk/electricity/retail-market/market-review-and-reform/smarter-markets-programme/electricity-system-flexibility. To be specified as commercially tradeable flexibility products, power adjustments are defined in terms of size or direction, duration and network location.

Market links	Local resources <-> con-/prosumers (Peer-to-Peer (P2P) trading) Local resources <-> DSO (DSO market for flexibility) Local resources <-> DSO <-> ESO (DSO-ESO platform(s) for flexibility) Local resources <-> ESO (aggregators)

Currently, markets are operated via separate platforms that fulfil different functions for different users (e.g. supplier trading platforms, ESO balancing services platforms, congestion management platforms). In future, a local energy market can combine a variety of **functionalities** within a single, integrated platform. For example, the Universal Smart Energy Framework (USEF) provides an international common standard for designing a flexibility market that enables the trading and commoditisation of energy flexibility. It defines a reference architecture, the tools and rules to make it work effectively, all stakeholder roles (new and existing), as well as how they interact and how they can benefit from these interactions. USEF fits on top of most market models and is already being adopted in smart energy projects across Europe[16]. In the UK, the framework is tested as part of "Project Fusion", developed under Ofgem's Network Innovation Competition[17].

Different actors can assume varying roles in the context of flexibility platform development (e.g. procuring resources, managing customers, purchasing flexibility services), as summarised in Table 7.

Table 7: Overview of market players in a flexibility platform.

Procurers	Providers	Independent actors
ESO/ TSO Seeks local flexibility to balance the wider electricity system.	**DER owners** Access new revenue streams for their flexible generation.	**Local market operator** A neutral market facilitator (not owning/ operating any market assets) that builds and manages the platform.
DNOs/ DSOs Seeks local flexibility to manage local network constraints.	**Customers** Domestic and industrial consumers/ prosumers able to flex their demand/ generation output for a price.	**Data communication hub** A third-party responsible for establishing and managing data and communications network among multiple parties.
Suppliers Seeks local flexibility to manage their electricity volume imbalance position.	**Aggregators** Pulls together smaller flexible resources and sells them as a single unit in the market.	

[16] For more information see: https://www.usef.energy/
[17] See Annex 1

	Suppliers/ ESCOs Directly managing customer demand to sell flexibility in the market.	

4.2. Key benefits and risk of LEMs

Markets offer an organisational environment for economic trading, providing financial incentives for the flexible use of resources in the energy system.[18] Historically electricity markets have been designed to reflect the 'conventional' centralised configuration of the system, relying on large-scale, transmission-connected generation assets and one-way power flows from generation to supply. There are four key drivers behind the ongoing change of the existing electricity system[19]:

- **Decarbonisation** – the need to reduce greenhouse gas emissions;
- **Decentralisation** – the impact that a growing number of DERs will have on the energy system;
- **Digitisation** – new ways to design and operate the energy system across all levels due to new IT technologies;
- **Democratisation** – consumers playing a greater role in the future energy system.

These system changes are driving an increasing need and opportunity to engage in more active management of smaller scale resources and underpin the emergence of LEMs. In future, local energy markets could become increasingly valuable as mechanisms to manage local network constraints that arise with growth in distributed renewable energy resources and rising demand from electrification of heat and transport. From a social and organisational point of view, creating markets in which local sources can participate directly has potential to unlock additional community benefits through local projects. The following sections discuss the range of potential **benefits** and **risks** associated with setting up a LEM.

4.2.1. Key benefits

The creation of a LEM can support a variety of objectives, including, among others, the facilitated integration of decentralised low carbon resources into the energy system and national markets; enabling the improved management of network constraints at a local level, and maximising social benefits for local communities. Key benefits have been identified as:

1. **Network benefits[20]**
    a. **Network loss reduction** – reducing energy flows by matching local generation and demand at times of high energy flows, leading to lower losses and possibly lower costs. The benefit is not universal, since adding generation in a generation-dominated area and demand in a

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[18] Eid et al. (2016) Market integration of local energy systems: Is local energy management compatible with European regulation for retail competition? Available from: https://www.sciencedirect.com/science/article/pii/S0360544216311859
[19] Bray, R. and Woodman, B. (2018) Unlocking Local Energy Markets. Available from: www.ukerc.ac.uk/network/network-news/unlocking-local-energy-markets.html
[20] Ofgem (2017) Local Energy in a Transforming Energy System. Available from: https://www.ofgem.gov.uk/system/files/docs/2017/01/ofgem_future_insights_series_3_local_energy_final_300117.pdf

demand-dominated area would increase rather than decrease losses. Benefits of reduced losses are factored into current network charge arrangements.

b. **Network constraints and deferring investment** – reducing energy flow at local peak time can avoid constraints in the short term and defer costly reinforcement investments further into the future. However, the current regulatory incentives for network companies to adopt demand side or flexible operational approaches to solve network constraints are less clearly developed than the incentives for long-term capital investments.

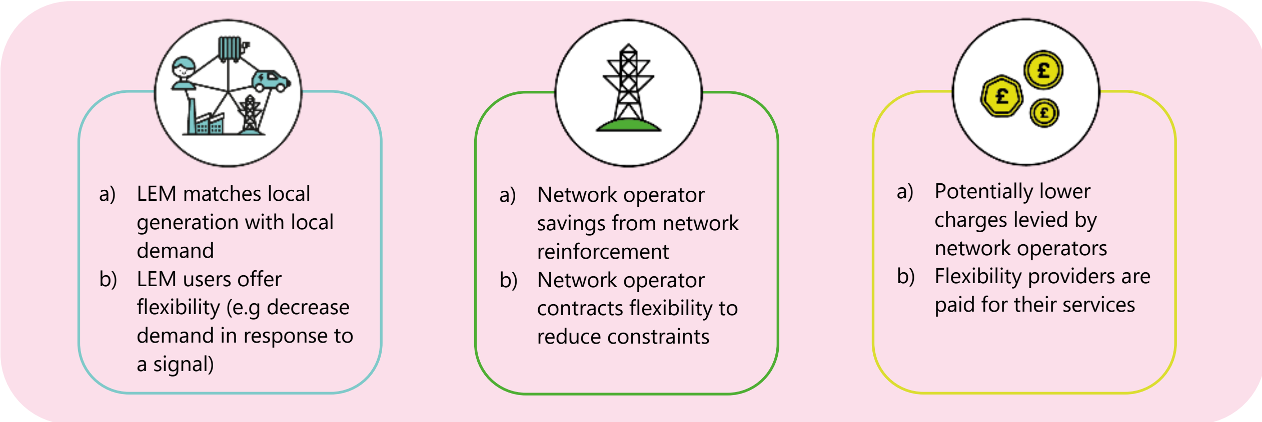

Figure 1: Potential network benefits of setting up a LEM

2. **Supporting small-scale renewable integration**
   a. **Active grid management** – by enabling local matching of energy supply and demand in network constrained areas, a LEM can support faster integration of renewable sources replacing more traditional RES infeed management techniques – e.g. *Last-in-First-Out*, rotational curtailment, etc. The feasibility of this approach will depend on the availability of local sources and DSR. In future, a LEM can develop to enable the dynamic pricing of network capacity, allowing users to trade network capacity rights.[21]
   b. **Stimulating investment** – LEMs can create a new route to market for excess generation from local small-scale installations following the closure of the Feed-in-tariff, creating a direct local alternative to the proposed Supplier Export Guarantee, or supporting the creation of a transparent reference price for local energy for suppliers involved in the scheme.

3. **Improving hedging for small scale users** – the availability and access to local flexibility could help small-scale/local suppliers better manage the imbalance risk i.e. the costs associated with the imbalance between contracted electricity generation and the actual consumption[22].

4. **Unlocking local demand-side flexibility** – can create incentives for demand-side flexibility on a smaller scale (e.g. domestic DSR) than that required for participation in the national balancing, ancillary services and capacity markets. It is also a route to market for small-scale local aggregators.

[21] Subject to outcomes of regulatory review of network access, currently at initial assessment stage.
[22] Ibid.

5. **Supporting local social objectives**

   a. Potential reduction in local energy bills.
   b. Community/individual consumer empowerment (option for communities/users to sell services to each other, e.g. P2P) and receive a financial reward for providing flexibility to network companies (e.g. selling services to grid).

While a LEM could potentially bring about the benefits listed above, it is important to highlight that it does not necessarily represent the optimal solution to address all the local or national challenges arising from the transition to a low-carbon energy system. In the specific case of managing network constraints, for example, alternative options could also be considered e.g. active network management[23]. Setting appropriate regulatory incentives for DNOs to minimise costs and assess alternative solutions for traditional network reinforcement could be key in unlocking potential price signals at local level. The approach that DNOs take towards contracting for flexibility through a LEM will be shaped by the requirements set by Ofgem through the RIIO process.

4.2.2. Key risks

The establishment of a LEM could also carry risks that should be acknowledged and carefully considered at the earliest stages of a LEM development, and could include:

- Increasing system imbalance if local actions are not coordinated with actors outside of the local market (e.g. ESO, DNO, suppliers whose assets are used by local aggregators)
- Limiting possible efficiency gains if access to the LEM is restricted
- Limited platform interoperability and integration with future markets
- Limited coordination with local DNOs with respect to local network conditions
- Managing conflicting requests where local resources are contracted to provide both local- and national-level flexibility services (DNO-ESO coordination)
- Ensuring data and consumer protection requirements are not overlooked.

From a broader perspective, it is important that the potential benefits for users participating in the local market are not realised at the expense of other users of the system but reflect value or savings for the wider system. Regulatory reforms currently underway, such as Ofgem's ***Targeted Charging Review*** (TCR), are designed to limit unintended consequences e.g. users avoiding contribution to the recovery of residual network costs while their actual impact (physical and financial) on the network remains unclear.

Clear analysis of expected market liquidity together with costs and benefits for local and broader system users would be essential to ensure emerging LEMs maximise value for their users and the use of available resources. Such analysis will also allow LEM concept designs to scale up and adapt to future changes in the wider system.

4.3. Challenges for local energy markets

[23] Ofgem (2017) Local Energy in a Transforming Energy System. Available from: https://www.ofgem.gov.uk/system/files/docs/2017/01/ofgem_future_insights_series_3_local_energy_final_300117.pdf

As highlighted above, some existing arrangements pose challenges to the development of LEMs in the short term. These include:

1. **DNO to DSO transition**
   Many of the proposed models for local flexibility markets envision a role for the DSOs to coordinate and/or be the procurer of flexibility services. However, there is currently no set timescale for DNOs to transition to becoming DSOs. Further clarity on the future role of the DSO in managing the local networks and procuring flexibility services will also be required.
2. **Half-Hourly settlement (HHS) of domestic customers**
   Half-hourly metering of domestic customers is currently not a widespread practice, due to the slow uptake of smart meters. Nevertheless, it is a crucial prerequisite to unlocking domestic flexibility that could be traded in local markets.
3. **Supplier hub model**
   The existing model that sees licensed suppliers as the main actors solely responsible for essential functions in the UK energy market (e.g. balancing, settlement, billing, etc.), in practice preventing alternative trading arrangements from emerging (e.g. local P2P trading).
4. **Restricted access to markets**
   Wholesale, ancillary, balancing and capacity markets in the UK have technical and minimum size requirements that often prevent DSR, storage and DER from entering those markets without aggregation.
5. **Administrative burden**
   Complex regulatory and administrative requirements for market participants disproportionately impact new, smaller actors compared to incumbents, given their more limited internal capacity and resources.

It is also unclear whether local energy market platforms would need to comply with existing network codes, or if new codes need to be developed to govern interactions between different local and national market platform developers and operators. The main issues that would need clarification include platform status and responsibility with respect to code compliance (e.g. whether they would be licenced/regulated or responsible for balancing and settlement reporting on behalf of their users), responsibility allocation between different platform owners (e.g. local market, DNOs, ESO), and data sharing arrangements.

The next section highlights some of the more significant changes that the overarching policy and regulatory framework is undergoing at present, creating both risks and opportunities for LEM projects.

5. Near/medium-term policy and regulatory future for LEMs

There are several areas where significant policy and regulations development processes are currently underway that would likely impact the development of local resources and local energy markets. This chapter provides a brief description and high-level qualitative assessment of the likely impact of the following ongoing processes:

- DNO/DSO transformation;
- Market-wide half-hourly settlement reform;
- Network charging reforms[24];
    - Access and forward-looking charges (SCR)
    - Residual charges and embedded benefits[25] (TCR)
- Future of retail supply and the supplier hub model;
- Governmental support for renewable energy

These are briefly summarised in Table 8, which highlights their likely impact and potential significance, current status and degree of uncertainty in the future direction of policy change.

Table 8: Summary of near and medium-term policy and regulatory developments and their likely impact on future local energy markets.

Policy/regulatory area	**Potential significance**	**Impact on LEMs**	**Current status**	**Degree of uncertainty in future direction of change**
DNO/ DSO transformation	**High** Defines future role for DSO and DSO/ESO cooperation, including role in local energy markets.	**Likely positive** Development of flexibility products for DNOs, creating demand for use of local sources.	ENA assessing five future worlds (see below).	**High** trials ongoing to develop capabilities and test different arrangements[26]; all options open at present.
Market-wide half-hourly settlement reform	**Medium** Enables half-hourly settlement and more granular data collection/accurate pricing signals.	**Likely positive** More accurate price signals for end users can create incentives to participate in a LEM.	Awaiting decision on whether to require all suppliers to settle on half-hourly basis in H2 2019.[27]	**Low** Targeted operating model to deliver HH settlement developed; timing of implementation uncertain.

[24] Residual charges are used to pay for existing network infrastructure. Unlike the forward-looking charges intended to fund investments in new network capacity, they are not intended to reflect users' impact on costs or send price signals to use the network in a particular way.
[25] The term "embedded benefits" describes the different transmission charging arrangements (including balancing system charges) for smaller embedded generators (i.e. those connected at distribution level).
[26] See Annex 1 - Overview of current flexibility projects in
[27] For further details see Ofgem's website: https://www.ofgem.gov.uk/electricity/retail-market/market-review-and-reform/smarter-markets-programme/electricity-settlement

Network charging – Targeted Charging Review	**Medium** Changes to embedded benefits and the way cost recovery charges are levied on network users.	**Uncertain, indirect** Can impact future market liquidity by changing incentives for investment in distributed energy resources.	Awaiting final decision (June 2019).	**Low** 'Minded-to Decision' to move to fixed charge or capacity charge published; timing for implementation uncertain.
Network charging – Access and Forward-Looking Charges	**High** Defines future of network access arrangements and forward-looking price signals, incl. options to increase temporal and locational elements to network charges.	**Uncertain, direct** Might impact locational choices for asset investments. Might create local network capacity markets. Network and market signals will interact to influence asset investment choices.	Initiated in December 2018. Awaiting working paper publications.	**High** 'Minded-to-Decision' expected in 2020; Final decision in early 2021.
Future of retail supply and the supplier hub model	**Medium/Low** Impact on viability of *some* business models without supplier intermediation (e.g. P2P).	**Likely positive** Likely positive for some business models, but uncertain of whole system impacts.	In 2018 Ofgem concluded that hub arrangements will not be fit for purpose. Review process under development.	**High** Detailed plan on future reform not published at present[28]. Industry review of specific arrangements ongoing (see **Box 1** p.27).
Governmental support for renewable energy	**Medium** Impact on future investment in renewable resources and asset availability.	**Uncertain, technology specific** Changes to support schemes likely to impact investment choices and LEM market liquidity in future.	Supplier export guarantee suggested as short-term replacement for FiT. Pending decision. RHI confirmed until 2020/2021.	**Medium** Degree of policy uncertainty (e.g. timing of CfD auctions, technologies supported). BEIS white paper on energy policy expected in 2019.

[28] Ofgem (2018). Future supply market arrangements – response to call for evidence. Available from: https://www.ofgem.gov.uk/publications-and-updates/future-supply-market-arrangements-response-our-call-evidence

5.1. DNO/DSO transformation process

The ENA's Open Networks Project is an industry-led initiative investigating the transformation of the UK's smart grid. The project is led by the 10 electricity network operators/owners in the UK and Ireland and includes representation from Ofgem and BEIS. The project is ongoing and open for input from wider stakeholders through consultation and review processes[29]. Part of the project assessed five different future structures of the electricity system, known as "Five Worlds"[30].

- World A: **DSO coordinates** – a world where the Distribution System Operator (DSO) acts as the neutral market facilitator for all Distributed Energy Resources (DER), and provides services on a locational basis to National Grid in its role as the Electricity System Operator (ESO).
- World B: **Co-ordinated DSO/ESO procurement and dispatch** – a world where DSO and ESO work together to efficiently manage networks through coordinated procurement and dispatch of flexibility resources.
- World C: **Price driven flexibility** – a world similar to World B, but where the price flexibility arrangements (access and signals for active parties) have improved following the changes implemented through Ofgem's Reform of electricity network access and forward-looking charges (see Section 5.3.2).
- World D: **ESO coordinates** – a world where the ESO is the counterparty for DER with DSO's informing the ESO of their requirements.
- World E: **Flexibility coordinator(s)** – a world where new national (or potentially regional) third party(ies) act as the neutral market facilitator(s) for DER, providing efficient services to the ESO and/or DSO as required.

At present, the process of assessing possible costs and benefits of these different pathways is still ongoing, and the nature of the future local system operation remains to be determined. Project Transition, led by SSEN[31] under Ofgem's Network Innovation Competition, aims to trial and demonstrate a Neutral Market Facilitator (NMF) Platform that would allow testing of the operation of the market models for DNO-DSO transition produced by the ENA Open Networks Project. The project aims to develop design requirements for a DSO Neutral Market Facilitator Platform, understand the roles and responsibilities that are required within the marketplace, and identify market rules, necessary for trials. The project started in late 2018 and is expected to deliver outputs over the course of 2019, with potential trials beginning in early 2020[32].

In December 2018, the UK's six DNOs committed to openly test the market for flexibility services to be able to compare them against traditional grid reinforcements. They also committed to working with industry and Ofgem as part of the forthcoming RIIO-2 price control framework development

[29] For more information visit ENA's website: http://www.energynetworks.org/electricity/futures/open-networks-project/open-networks-project-overview/

[30] For more information visit ENA's website: http://www.energynetworks.org/electricity/futures/open-networks-project/future-worlds/future-worlds-consultation.html

[31] Ofgem (2017). Project Transition, public submission of proposal under the Network Innovation Competition. Available from: https://www.ofgem.gov.uk/system/files/docs/2017/11/transition_public_v1.0_0.pdf

[32] For more information visit the project's website https://ssen-transition.com/

process, to better align financial incentives for use of flexibility services where it is more efficient than traditional infrastructure investments[33]. The methodologies for assessing alternative solutions against the cost of traditional network investments are still to be developed, but for the future price control framework Ofgem declared its intention to create a level playing field between demand and supply-side solutions to network constraints, including energy efficiency[34]. Establishing ways to assess and compare the cost-effectiveness of different solutions as part of regulated network activities would be key for unlocking potential value streams to local distributed resources.

Key points for consideration for LEM designs:

- **Interoperability** with future DSO/ESO platforms: in light of the future changes to the roles of the DSO/ESO, the LEM would need to have technical capabilities that enabled it to "speak" not only to existing platforms (ESO), but also to potential future platforms (if DSOs are to emerge as new market facilitators). Lack thereof would limit LEM participants' ability to access value streams across the electricity system.
    - ➢ **Which technical requirements will a LEM need to have?**

- **Revenue stacking**: LEM participants would likely benefit from accessing multiple revenue streams, thus enhancing the viability of their business models.
    - ➢ **How can access to multiple revenue streams by LEM participants be enabled?**

- **Managing conflicts** in market demands/signals: with potential multiple purchasers of energy and flexibility services in future, conflicting requests could arise and would require management.
    - ➢ **How could the design of a LEM ensure that price signals are maintained and coordinated?**

5.2. Market-wide half-hourly settlement reform

Electricity use is currently not metered in real-time, therefore delivery and demand must be verified after the event. Under current settlement arrangements, energy imbalance volumes are estimated for each half-hourly period based on demand profiles. Contract and metered volume and price reconciliation processes are run by Elexon in multiple stages, as new metered data becomes available. The deadline for final reconciliation is 14 months after the relevant trade period.

Market wide half–hourly settlement reform has been underway since 2017 in order to identify a way to move from current arrangements to using more accurate metering data (subject to its availability via smart meters). A Target Operating Model has been developed by an industry delivery group led by Elexon and is currently under review by Ofgem. The model specifies a set of services required to deliver settlement data over a 30-minute period, from smart meters to a central settlement body, to enable the calculation of imbalance settlement volumes and prices. This calculation is used in the imbalance settlement process, which compares the Supplier's contracted

[33] ENA (2018). Energy Networks Association's Flexibility Commitment. Available from: http://www.energynetworks.org/assets/files/ENA%20Flex%20Committment.pdf

[34] Ofgem (2018). RIIO-2 framework decision. Available from: https://www.ofgem.gov.uk/system/files/docs/2018/07/riio-2_july_decision_document_final_300718.pdf

purchase of energy to the amounts deemed to have been consumed (sales) by each of the Supplier's customers (and recognises any amounts of energy contracted by National Grid under the Balancing Mechanism).[35]

The introduction of market wide HH settlement could have a positive impact for many of the business models proposed by LEMs. It will enable local and national suppliers to provide time of use tariffs, and aggregators to accurately record the effect of their DSR deployment consumers, which could potentially lead to higher levels of customer engagement with LEMs. From the point of view of LEM development, it is **important to create processes that would allow the reconciliation of LEM transactions in line with system-wide balancing timelines**.

Key points for consideration for LEM designs:

- **Smart meters** and responsive tariffs could be key to enabling price signals to reach local platform users and unlock the local supply and demand for energy. Smart meters would also be required for data collection at half-hourly periods (which will likely be required for settlement purposes in future).
    - **How would smart meter data be collected (e.g. are smart meters already in place for future platform users or do they need to be provided by suppliers?).**

- **Consumer protection** mechanisms would need to be established at LEMs.
    - **How would individual data be managed in line with data protection requirements?**

- **Establishing balancing and settlement** processes within LEMs would be crucial to providing security for market participants. Consideration around how a LEM would interact with system-wide settlement processes and requirements are also key.
    - **How does the balancing and settlement processes work for the market and how would boundary interactions be defined?**
    - **How would sufficient data be provided so participants can meet industry requirements for balancing and settlement purposes?**

5.3. Network charging reforms

Network charging defines the way that network infrastructure costs are recovered from end users. It is part of the highly regulated aspect of electricity sector operation linked to monopoly price controls for network companies. There are two major reforms in the area of network charging at present that may impact the development of LEMs; indirectly, by influencing market liquidity and changing incentives to invest in local assets, or directly, by opening space for new forms of markets in network capacity rights. They are briefly reviewed in the following sections.

5.3.1. Targeted charging review: Significant Code Review

This review process considers changes **to residual electricity network charges,** which are used to recover the cost of existing infrastructure. These charges are levied by network owners once forward-looking network charges have been accounted for and serve to top-up the revenue requirements permitted for network companies under the regulatory price control framework (RIIO). The reform is aimed at removing signals to increase or decrease network usage, which a cost-recovery charge is not intended to generate – i.e. since the cost of investment in existing infrastructure is already incurred, modifying electricity use now would not lead to a real change in the costs that need to be

[35] For further information see Elexon's website: https://www.elexon.co.uk/group/design-working-group/

recovered, and would instead lead to re-distribution of those costs to other users of the network without realising real savings.

The scope of the review includes:

- How to apply the residual element of charges to all users of the transmission and distribution networks (generation, demand and storage)
- The removal of remaining non-locational embedded benefits (additional to already removed transmission demand residual payment).

Ofgem is considering the following key changes to existing arrangements as part of the review:

- Move residual charge payments solely to demand users (from generation and demand currently)
- Move away from per-unit consumption charges and peak transmission demand charges (Triad) to either fixed charges (per user) or ex-ante agreed capacity
- Remove remaining non-locational embedded benefits, including benefits to larger transmission connected generators and removal of embedded benefits stemming from charging suppliers for balancing services based on gross demand at relevant grid supply points
- Apply balancing services charges to smaller embedded generation.

Details of the reforms to network charging are still to be finalised, but experience suggests that it remains a challenge to design network charging rules that are cost-reflective, incentive-compatible and operationally practicable. An initial impact assessment suggested that the reform of residual charges could lead to potential net system benefits to 2040 in the range of £0.8bn to £3.2bn and benefits to consumers as a whole in the range of £0.5bn to £1.6bn.[36] A final decision on implementation is expected in mid-2019. Implementation times under consideration include 2020, 2021 and 2023.

5.3.2. Access and Forward-Looking Charges Significant Code review

Launched in December 2018, the **Access and Forward Looking Charging Review** seeks to evaluate and make changes to the **access arrangements** (the nature of users' access to electricity networks and how these rights are allocated) and the **forward-looking charges** (the element of the network charges that signals to users how their actions might increase or decrease network costs in the future). The review was launched with the aim of ensuring a more efficient and flexible use of networks, reflecting users' needs, and allowing consumers to benefit from new technologies and services while avoiding unnecessary costs[37]. The review includes:

- A definition and choice of access rights for transmission and distribution users (including firmness, time-profile and short-term access rights for large users; and choice and allocation of access rights for smaller users)
- Wide-ranging review of distribution network charges (Distribution Use of System (DUoS) charges), including options for greater locational granularity at lower voltage levels, higher

[36] For more details on the expected impact of the policy and reasoning for the suggested modifications, refer to Ofgem (2018) Targeted Charging Review: Minded to decision and draft impact assessment https://www.ofgem.gov.uk/publications-and-updates/targeted-charging-review-minded-decision-and-draft-impact-assessment

[37] Ofgem (2018) Electricity Network Access and Forward-Looking Charging Review - Significant Code Review launch and wider decision. Available from: https://www.ofgem.gov.uk/system/files/docs/2018/12/scr_launch_statement.pdf

predictability of locational signals at Extra High Voltage and the balance between time-of-use based usage charges and capacity-based charges)
- Review of the distribution connection charging boundary (possibility to move to shallow connection charge at distribution level, and allocation of risk for network investments (e.g. linked to user commitment)
- A focused review of transmission network charges (Transmission Network Use of System (TNUoS) charges).

Improving the allocation of access rights is also within scope of the review. This includes consideration of whether the scope for markets can be enhanced, e.g. with incremental improvements to queue management, reallocation (e.g. 'use it or lose it'/'use it or sell it' rules), and options to trade curtailment exposure, or access rights between users. The focus of the review is on distribution networks and is therefore likely to heavily impact possible local market developments (e.g. options to extend local market functions to trade network capacity rights might be considered as part of LEM project development).

Options for trading of curtailment obligations by non-firm generators with other parties, including demand and/or generation are also assessed as part of the reform[38]. The assessment results are expected to feed into other ongoing industry activities linked to the potential future of flexibility services at distribution network level, as part of Energy Networks Association's Open Networks Project[39]. The industry process is open for stakeholder engagement, and in 2019 is expected to cover several key areas linked to future DSO flexibility service offerings, listed in the table below.[40]

Table 9: ENA-led work on distribution level flexibility service procurement and provision

Workstream	Timeline
Flexibility Market Principles	Jan 19 – Jun 19
DSO Services – Procurement Processes	Jan 19 – Aug 19
DSO Services – Dispatch and Settlement Processes	Jul 19 – Oct 19
DSO Services – Commercial Arrangements	Jan 19 – Dec 19
DSO Services – Conflict Management & Cooptimisation	Jan 19 – Dec 19
Facilitation of new markets	Jul 19 – Dec 19

There is a high degree of uncertainty in the policy outcomes resulting from this review as it is in the early development stage. The reform has potential to introduce more granular locational and temporal price signals and unlock value for local energy.

Key points for consideration for LEM designs:

- Future of **network reforms**: a change in forward looking charges and network access could alter the final price signals end users are exposed to. These interactions need to be carefully assessed when evaluating the business case for LEMs. Options to enable secondary trade in

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[38] ENA (2019). Network-Led Access Rights Allocation Working Delivery Group meeting. Available from: http://www.chargingfutures.com/media/1303/delivery-group-industry-led-access-allocation-agenda-item-7.pdf

[39] ENA (2019). Flexibility Services. Available from: http://www.energynetworks.org/electricity/futures/open-networks-project/workstream-products/ws1a-flexibility-services.html

[40] ENA (2018). Flexibility Market Principles & Commercial Arrangements. Available from: http://www.energynetworks.org/assets/files/20190411%20WS1A%20P1%20Stakeholder%20Workshop.pdf

network capacity rights might also mean that a new market becomes available, potentially impacting import/export decisions for asset owners.

- **Will the change in network access charges have an impact on the profits of LEM participants (e.g. aggregator business models) and/or reduce benefits for its end users (e.g. local energy customers)?**
- **If reforms result in enabling a secondary market for trade in capacity rights, would that market be considered part of a combined LEM design (enabling simultaneous trade in energy and capacity)?**
- **Have LEMs engaged with local stakeholders to understand how network reforms (e.g. changes to the way residual network charges are levied) might impact the business plans of potential market/platform users?**

5.4. Future of retail supply and the supplier hub model

The supplier hub model represents the current arrangement whereby all consumer interactions with the electricity grid are conducted through the consumer's supplier. Suppliers may contract supplier agents for some elements of their operations (i.e. installing and maintaining metering equipment, collecting and estimating data or aggregating data for supplier volume allocation), but suppliers are responsible for meeting their license conditions. There are multiple options available for becoming a licenced supplier, including a full supplier licence; operation through a partnership under a licence lite or white label arrangement, and engaging in commercial peer-to-peer contracts via sleeving arrangements (see Annexe 1).

Under current arrangements, consumers cannot buy electricity from a local DER without contracting through their respective suppliers, who remain accountable for any energy imbalance volumes on behalf of their customers. Existing peer-to-peer trials have been implemented through partnerships, with a fully licenced supplier remaining responsible for code compliance and consumer protection, and the other parties involved in trial projects becoming licence exempt suppliers (see Annexe 1).

For LEMs to sell electricity to consumers, or dispatch consumer flexibility without becoming a single point of contact for their customers' electricity needs, changes would be required to the current supplier hub model. Ofgem recognises the need to move away from this model of engagement, but due to the scale of change, the reform process is expected to be protracted[41]. There is currently no indication of when or how a large-scale regulatory review process would be initiated. However, several industry code modifications are being proposed and implemented to support more active engagement of users, including multiple suppliers for a single meter point (see Box 1).

[41] Ofgem (2018). Future supply market arrangements – response to call for evidence. Available from: https://www.ofgem.gov.uk/publications-and-updates/future-supply-market-arrangements-response-our-call-evidence

Box 1. Supplier hub model: Balancing and Settlement Code (BSC) modifications

Two balancing and settlement code modifications that are currently under review will support new business models currently limited by the supplier hub model, by easing metering of energy for separate purposes and independently of primary suppliers:

P379 'Multiple Suppliers through Meter Splitting' – Enabling consumers to buy and sell electricity from/to multiple providers through Meter Splitting.

- Aims at creating competition for behind-the-meter energy volumes by removing the need to reach an agreement with a single default supplier responsible for a customer's settlement meter.
- Proposes a new role under the BSC to reconcile power flows and in turn enable multiple Trading Parties to reflect these volumes in their bills and payments to consumers. Expected positive impact on:
    - community energy schemes
    - providers of electric vehicle (EV) and other consumer appliances offering a bundled electricity supply
    - peer-to-peer trading participants and other local market developers.

P375 'Metering behind the Boundary Point' – Settlement of Secondary BM Units using metering behind the site Boundary Point.

Proposes to settle Secondary Balancing Mechanism (BM) Units using metering equipment behind 'behind the meter', rather than settling using Metering Equipment at the Boundary Point as per current BSC obligations.

This will allow balancing-related services on site to be separated from imbalance-related activities, more accurately reflecting the balancing-energy volumes provided by the Balancing Service Provider (BSP).

Key points for consideration for LEM designs:

- **LEMs as point of contact to customers:** A reform on the role of suppliers as a single point of contact for end customers is foreseen but remains highly uncertain. Several code modifications are underway, which if implemented, would enable multiple suppliers to deliver energy to a single user, but they too, remain highly uncertain. It is likely that if LEMs enable direct trade between end users, they would need to act in line with existing industry rules (e.g. operate via a licenced supplier)
    - **How would LEMs contract with customers in the short term to enable trade between them?**
    - **Would a licencing arrangement be sought, a partnership with licenced suppliers established, or would the market be open for licenced entities only?**

5.5. Governmental support for renewable energy

Since existing governmental support schemes are considered a form of state aid provision, and rules preclude recipients from receiving other revenue while receiving payments (e.g. FiTs, CfDs), resource providers in LEMs would likely need to opt out of alternative payments. This has been the case for projects currently participating in peer-to-peer trade trials as part of Ofgem's Innovation Link/Sandbox process (see Annexe 1). The Smart Export Guarantee expected to replace existing schemes could offer a competing source of revenue for local resources by directly creating a route to market for them in national markets. Alternatively, LEMs can emerge as useful price reference points for local energy.

Key points for consideration for LEM designs:

- **Interactions with renewable energy incentives**: It is important for LEM designs to consider the rules and possible requirements for local distributed energy generators wanting to participate in the LEM, including whether they would need to opt-out of existing revenue generating activities; or whether they would be able to participate in LEMs if they hold alternative contracts (e.g. if the capacity market mechanism is restored and low-carbon generators are successfully enabled to participate).
    - **How would interactions with existing and proposed renewable energy schemes impact the number of participating resources in a LEM?**

6. Further considerations

In addition to specific policy and regulatory reforms currently underway, local energy market projects would need to consider several critical aspects to be able to deliver smart integrated designs, including consumer protection, data and cyber security, market integrity and interoperability. These topics are briefly highlighted below.

Consumer protection

As the energy system transformation evolves, new forms of consumer protection will become necessary. Since electricity is an essential service, consumer protection should always be a critical component of new business model development. For instance, when engaging with consumers in novel ways to buy energy, it is important to ensure that they know what they are buying, know how to get problems diagnosed and fixed, and can compare and switch to the new offers available[42]. Rules and obligations to disclose information to customers are already embedded in supply licences[43]. The regulatory and policy framework will also evolve to reflect new risks, which in the longer term might translate to new requirements for businesses[44].

Data and cyber security

As the energy system becomes more reliant on digital and data systems for normal operation, the risk that such systems would be used or tampered with for malicious purpose increases[45]. Cyber security, data privacy and data protection are all significant risks that must be mitigated. Data security can key to the overall resilience and security of the energy system.

The information system needed to support the LEM, connect market participants, and potentially monitor market operations would need to be designed and continuously developed taking such risks into account. At industry level, initiatives such as the Energy Data Taskforce are investigating how the use of energy data can be transformed across the energy sector. The Taskforce has provided recommendations to Ofgem, Government and Innovate UK on how to enable more effective data sharing and use[46].

Market integrity

Another critical element of market development is ensuring that relevant stakeholders and market participants have confidence in market functioning and integrity. It is necessary to ensure that prices reflect a fair and competitive bidding processes, that non-competitive practices are not exercised to participants' detriment, and that there are clear governance and operational rules, including transparent arrangements linked to change in existing market rules once they are set.

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[42] ESC (2018). Smarter Protection Potential risks for consumers in a smart energy future: Closing report. Available from: https://es.catapult.org.uk/wp-content/uploads/2019/05/Smarter-Protection-potential-risks-report-for-release-with-edits-1.pdf

[43] Ofgem (2019). Licence guide: information for consumers. Available from: https://www.ofgem.gov.uk/publications-and-updates/licence-guide-information-consumers

[44] For example, Ofgem is currently in the process of updating their Consumer Vulnerability Strategy. For more information see: https://www.ofgem.gov.uk/publications-and-updates/draft-consumer-vulnerability-strategy-2025

[45] For more information refer to ESC (2018), Energy Data Review Summary Report, available from: https://es.catapult.org.uk/wp-content/uploads/2018/12/Energy_Data_Review_Summary_Final.pdf

[46] For more information see BEIS' website: https://www.gov.uk/government/groups/energy-data-taskforce

Regulations already exist to set obligations and requirements linked to market integrity and transparency for wholesale energy markets in the EU[47]. Similar to the existing framework, it would be useful to consider the following aspects when setting a LEM:

- Information disclosure and reporting
- Market participant and asset registers
- Market monitoring
- Prohibition of practices undermining the integrity of the market (e.g. insider trading and market manipulation)

When designing a LEM it is important to avoid undue administrative burdens for market participants in order to encourage participation while ensuring that the market functions transparently. It is key to consider how a LEM will interact with existing energy market reporting and settlement systems, and how the market will evolve as the wider system changes in future. It is also necessary to develop realistic assumptions and project roadmaps to future change if these are assumed.

Interoperability

Interoperability is the ability of a product or system to cooperate with other products or systems to share resources. Interoperability is an important component of smart local energy system design that covers consumer, commercial, data, physical, vector and device aspects[48]. When setting up a local energy system and market, several challenges would need to be addressed, including issues around market boundary definition, integration and movement across boundaries, potentially conflicting commercial motivations or demands on assets, scaling and asset control. It is important to identify such interoperability challenges and potential solutions to support the projects integration in the wider energy system.

[47] For more information see Ofgem's website: https://www.ofgem.gov.uk/electricity/wholesale-market/european-market/remit

[48] ESC (2018), An Introduction to Interoperability in the Energy Sector. Available from: https://es.catapult.org.uk/news/an-introduction-to-interoperability-in-the-energy-sector/

7. Conclusions

The policy and regulatory landscape in the electricity sector is undergoing significant changes at present and will continue to evolve as patterns of electricity generation and use alter. Emerging changes in the way the system is operated – especially the shift to a more active role for network companies or other actors at distribution network level – create both risks and opportunities for local energy market developers. To be able to navigate this complex transition process, we recommend projects:

1. **Ensure compliance** – understand whether project activities require a generation, distribution or supply licence and ensure this is acquired or partner with a provider who already holds a licence. The best place to get information on the regulatory compliance of an idea is Ofgem's Innovation Link service.
2. **Join industry initiatives** – industry-wide initiatives such as the Open Networks Project and Power Responsive provide an opportunity stay informed and contribute to discussions surrounding sector transformation. Such forums often provide regular updates and invite stakeholder input via different consultation processes and workshops.
3. **Stay informed on policy developments** – BEIS and Ofgem provide regular updates on ongoing policy and regulatory developments and engage with stakeholders via statutory consultation processes and other stakeholder engagement activities. Subscribe for updates here: Ofgem , BEIS.
4. **Engage with resource providers** – projects should communicate closely with potential LEM users in their given area/s to understand their needs and how they could be impacted by the changing policy landscape.
5. **Ensure consumer protection** – those supplying energy services to customers must comply with consumer protection requirements, including rules around provision of information, frequency of billing, etc, which are embedded in standard supply licence conditions. Suppliers and projects should also ensure they are compliant with data protection requirements, including GDPR. Find out more at the ICO's website.

8. Appendix

8.1. Acronyms

BEIS – Department for Business, Energy and Industrial Strategy

BM – Balancing Mechanism

BMU – Balancing Mechanism Unit

BSC – Balancing and Settlement Code

CfD – Contracts for Difference

DER – Distributed Energy Resources

DNO – Distribution Network Operator

DSO – Distribution System operator

DSR – Demand Side Response

ENA – Energy Networks Association

CM – Capacity Market

ERDF – European Regional Development Fund

ESCO – Energy Service Company

ESO – Energy System Operator

EV – Electric Vehicle

FFR – Firm Frequency Response

FiT – Feed in Tariff

GDPR – General Data Protection Regulations

HH – Half Hourly

LEM – Local Energy Market

LLF – Line Loss Factor

NIC – National Infrastructure Commission

P2P – Peer-to-Peer

PFER – Prospering from the Energy Revolution

PPA – Power Purchase Agreement

RES – Renewable Energy Sources

RO – Renewable Obligation Certificate

SEDC – Smart Energy Demand Coalition

STOR – Short Term Operating Reserve

TCR – Targeted Charging Review

TERRE – Trans European Replacement Reserves Exchange

TSO – Transmission System Operator

USEF – Universal Smart Energy Framework

V2G – Vehicle to Grid

VLP – Virtual Lead Party

8.2. Glossary

Electricity balancing services[49] - The UK wholesale market is based on bilateral contracting between electricity generators and suppliers who aim to balance their individual contracted positions. However, when individual imbalances occur (mismatches between pre-contracted positions and physical delivery/consumption), National Grid ESO fulfils a statutory residual role in ensuring that the system's overall supply and demand remains in balance. This role in balancing the system is set out in primary legislation and is regulated through Ofgem. It is specified in detail in transmission licence conditions and in a series of codes, including a Balancing and Settlement Code. A distinction is made between 'energy balancing' actions, and balancing actions taken for non-energy, system management reasons, referred to as 'system balancing' actions.

Flexibility - modifying generation and/or consumption patterns in reaction to an external signal (such as a change in price) to provide a service within the energy system. Flexibility products are defined as power adjustments in specific size or direction, sustained for a given moment and for a given duration from a specific network location.

Grid management platform[50] - A platform that enables the TSO/ DSO to operate and maintain the grid by acquiring *grid management services*. These include both *congestion management* (regulated mechanism imposing trade and/or dispatch restrictions, possibly non-voluntarily) and *grid capacity management* (using flexibility as an alternative to grid reinforcement without trade or dispatch restrictions and always offered on voluntary basis)

Imbalance position[51] - In the wholesale electricity market in the UK, organisations that require electricity for their customers (suppliers), enter into contracts with organisations that produce electricity (generators), sometimes through intermediaries. The basic trading period for electricity is half an hour. Each half-hour unit called a Settlement Period. Suppliers will calculate the estimated electricity requirements for their portfolio of customers for each half-hour settlement period. They then enter into contracts with generators so that their customers receive the correct quantity of electricity for each Settlement Period. A market participant is in imbalance when its contracted volumes do not match its metered volumes (after accounting for possible adjustments by ESO following the official end of a half hourly trading period, known as gate closure).

Interoperability[52] - Interoperability is the ability of a product or system to cooperate with other products or systems to share resources. There are multiple types of interoperability, including consumer, commercial, data, device, physical and vector interoperability.

Trading platform[53] - A trading platform is software used for opening, closing, and managing market positions through a financial intermediary. Online trading platforms are frequently offered

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[49] National Audit Office (2015). Briefing Electricity System Balancing. Available from: https://www.nao.org.uk/wp-content/uploads/2014/05/Electricity-Balancing-Services.pdf

[50] USEF (2018) White Paper – Flexibility Platforms. Available from: https://www.usef.energy/new-white-paper-flexibility-platforms/

[51] Elexon (2019). Imbalance Pricing. Available from: https://www.elexon.co.uk/documents/training-guidance/bsc-guidance-notes/imbalance-pricing/

[52] ESC (2018). An introduction to interoperability in the energy sector. ESC Discussion paper. Available from: https://es.catapult.org.uk/news/an-introduction-to-interoperability-in-the-energy-sector/

[53] See e.g. https://www.investopedia.com/terms/t/trading-platform.asp

by brokers either for free or at a discount rate in exchange for maintaining a funded account and/or making a specified number of trades per month.

Prosumer – an individual who both consumers and produces a particular commodity (in this case energy).

Imbalance settlement[54] - the process of reconciling an individual party's imbalance positions following the end of a trading period and post National Grid ESO's use of balancing mechanism tools to balance the electricity system in real time. Various IT systems are used by Elexon, the body responsible, for the imbalance settlement process. Known as "Balancing and Settlement Code Central Services", the main IT systems include central volume allocation (handling contract, metering and generation data); supplier volume allocation (including grid supply point offtake and supplier meter data handling); and funds administration (including billing reports, imbalance charge calculations and payments).

[54] For more details see Elexon's website: https://www.elexon.co.uk/knowledgebase/trading-settlement/

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9. Annex

Annex 1 - Overview of current flexibility projects in the UK

These is no clear definition of "local energy" or "local market" schemes in the UK at present. In a recent discussion on the topic, Ofgem defined several local energy "archetypes" including local customer service provision, local generation, local supply, micro-grid and virtual power networks[55].

Local energy optimisation and trade arrangements are currently tested across the UK. Projects operate under several schemes, including:

- As part of regulated network activities (flexibility market projects run by DNOs under Ofgem's NIC competition)
- As individual trials granted temporary derogations under Ofgem's Innovation link/Sandbox process;
- As part of other innovation funding streams (e.g. ERDF, PFER).

Where platforms/markets exist, requirements are localised and there are no standard products.

Project	Description	Assets used	Run under/ financed	Implementation
Cornwall Local Energy Market[56]	A virtual marketplace for flexible energy capacity to be sold to local and national grid and wholesale market.	Renewable generators, businesses, households, large energy users, energy storage providers	Private financing; ERDF.	- Licenced supplier - DNO and ESO placing bids for flexible capacity onto the platform for participants to make offers against - Where conflicting requests – DNO bids have priority; excess flexibility then goes to ESO - Solar PV and batteries installed in 100 residential homes aggregated in a Virtual Power Plant - 60 business participating with resources (some receiving batteries)

[55] Ofgem (2017). Future Insights Series. Local Energy in a Transforming Energy System. Available from: https://www.ofgem.gov.uk/system/files/docs/2017/01/ofgem_future_insights_series_3_local_energy_final_300117.pdf

[56] For further information visit project website: https://www.centrica.com/innovation/cornwall-local-energy-market

Green Energy Networks, SmartKlub and SIG – Trial 1 Cannock Chase	Software aimed at local resource optimisation: balancing community supply-demand; switching between use of solar PV, storage, grid electricity; time-of-use-tariff selection.	Local demand, local PV generation, battery storage	Ofgem Sandbox trial[57]	- Establishment of community Energy Services Company (ESCO) – licence exempt - Partnership with licenced suppliers for wider system/industry obligations - Partnership with aggregator to sell local residential balancing and flexibility services to ESO/DNO
Green Energy Networks, SmartKlub and SIG – Trial 2 Trent Basin	As above. Location is a brownfield site (joint venture development).	Local demand, PV solar panels and a community battery		- Community ESCO established – licence exempt - Partnership with licenced supplier; - Partnership with aggregator
Verv; Repowering London – Trial 3	Developing a platform to test peer-to-peer electricity trading.	Community solar PV		- One party becoming licence exempt supplier; - Partnership with licenced supplier - One consumer bill with two separate lines for energy supplied
BP – Trial 4	Developing a platform to allow prosumers to sell excess electricity in a marketplace. Simulated trade (no physical flows); based on real-time data.	Self-generation assets (not specified).		- Licenced supplier - Trial with 250 domestic customers across GB - Simulated trade via platform - Participants receiving savings if simulated trades result in prices lower than their normal tariff
Project Fusion - SPEN[58]	Trial a market framework called the Universal Smart Energy Framework.	Multiple - range of energy storage techniques in the form of batteries,	Ofgem NIC[59]	- Implement USEF across North East Fife as a new open access marketplace for flexibility

[57] Ofgem (2018). Innovation Link: Enabling trials through the regulatory sandbox. Available from: https://www.ofgem.gov.uk/publications-and-updates/innovation-link-enabling-trials-through-regulatory-sandbox
[58] Ofgem (2018). SPEN project Fusion submission. Available from: https://www.ofgem.gov.uk/system/files/docs/2017/04/spen_fusion_2017_nic_isp.pdf
[59] Full list of NIC project available from Ofgem: https://www.ofgem.gov.uk/network-regulation-riio-model/current-network-price-controls-riio-1/network-innovation/electricity-network-innovation-competition

	The Project aims to demonstrate an approach for DNOs to harness flexibility to manage networks.	electric vehicles, compressed air, hydrogen, solid oxide fuel cells and Power to Gas; customers; generation in the region.		- Setting up flexibility market with access for network operators, suppliers, aggregators, flexible demand customers - Trial settlement process conducted within existing policy/regulatory arrangements
Project Transition – SSEN[60]	Trial and demonstrate a Neutral Market Facilitator (NMF) Platform to test the operation of the market models for DNO-DSO transition being produced by the ENA Open Networks Project.	Multiple – to be trialled in several geographical areas and on several network typologies.	Ofgem NIC	- Develop design requirements for the platform - Develop the roles and responsibilities within the marketplace - Develop the market rules required for the trials - Implement and test the concept for the Platform

[60] Ofgem (2017). Project Transition public submission under Network Innovation Competition. Available from: https://www.ofgem.gov.uk/system/files/docs/2017/11/transition_public_v1.0_0.pdf

Annex 2 - Supply licence options and conditions

Supply is defined in the Electricity Act 1989 as supply to premises in cases where (a) it is conveyed to the premises wholly or partly by means of a distribution system, or (b) (without being so conveyed) where it is supplied to the premises from a substation to which it has been conveyed by means of a transmission system. While the exemptions framework provides for a non-licensed form of supply (Class A exempt supply allows the supply of self-generated power to domestic consumers of up to 2.5MW) there are no exceptions allowed. **Anyone selling power to premises that is conveyed by way of electrical wires is performing the function of supply.**

Option[61]	Features
Licensed supplier	• Licence granted by Ofgem to permit the supply of electricity to domestic and / or non-domestic premises in the UK • A licence application fee applies • Licensees have to become a party to and comply with the relevant industry codes • Responsibilities include consumer protection, social and environmental obligations • Suppliers with a domestic supply licence are required to offer terms to all domestic consumers that make a valid request • A restricted supply licence may be applied for, although we will consider, amongst other things, whether it can be justified in terms of public interest
Licence Lite supplier	• Party applies for an electricity supply licence (as above) and requests Ofgem approval not to become party to some of the industry codes • Code responsibilities are delivered via a commercial relationship with another (third party) licensed supplier (TPLS) • The licence lite supplier remains fully licensed and responsible for compliance with all other elements of the licence

[61] Ofgem (2017). Regulatory options for supplying electricity to consumers. Available from: https://www.ofgem.gov.uk/publications-and-updates/regulatory-options-supplying-electricity-consumers

Option[61]	**Features**
	• Reduces entry and operational costs by outsourcing elements of code compliance to another licensed supplier
Licence Exempt supplier	• Legislation allows supply without a licence up to certain thresholds and in particular circumstances • Exempt supplier may need to make arrangements with a licensed supplier (to perform industry compliant functions) • Exempt supplier is subject to legislative requirements, based on key customer-facing requirements from the conditions of the electricity supply licence (e.g., giving customers contractual information, regular bills and notice of price increases)
White Label	• Partnership between licensed supplier and third party to offer branded tariffs • Models vary, but the white label acts as an agent (and therefore under the control of) a licensed supplier (e.g., if they carry out activities involving customer acquisition or other customer interactions) • Licence requirements, including code compliance and consumer protection, sit with the licensed supplier
Sleeving	• Licensed supplier provides commercial peer-to-peer services for participants (generator and consumer(s)) • Often used by organisations with own-generation on one site who are seeking to supply load onto another site, across the public network

Energy Systems Catapult supports innovators in unleashing opportunities from the transition to a clean, intelligent energy system.

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