Scottish & Southern Electricity Networks

Future Networks

Social Constraint Managed Zones – Process Evaluation

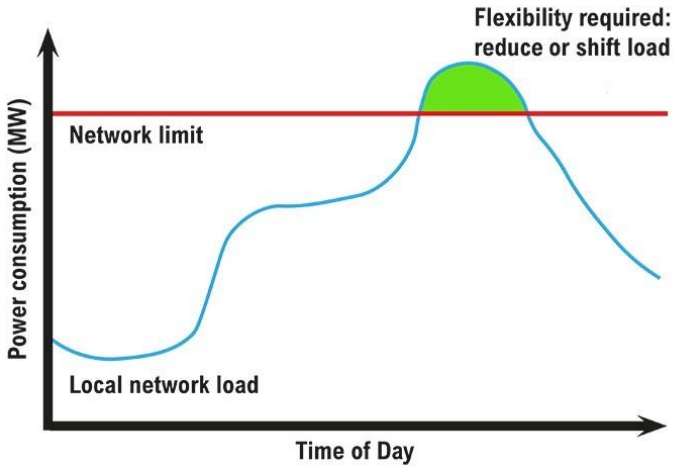
Contents

Scottish & Southern Electricity Networks

1 Executive Summary

The rapid increase in renewable energy generation has prompted a strong electrification of the energy system. The changes in supply and demand impact the power system. More (peak) capacity is needed and operability becomes more challenging due to the intermittency from (distributed) resources, causing reverse power flows and balancing challenges at ever shorter time scales. Poles and wires investments at the distribution level in the network are currently made to ensure that local peak demand is met. As more and more renewable energy sources, storage, electric vehicles and smart home appliances, such as smart washing machines, are being integrated at the distribution level in the system, flexible resources are required to deal with uncertainty, peaking and variability in supply and demand.

Network investments, however, could be partly deferred or avoided through energy efficiency and flexibility. To support this approach, the concept of Constrained Managed Zones (CMZ) has been developed in the UK. CMZ are geographical areas served by an existing distribution network but with potential needs for network reinforcement in the near future to deal with local capacity constraints. In these designated areas, a tender process is opened to procure flexibility services to defer network investments by reducing or managing demand from consumers in the area.



Untapped potential of community flex

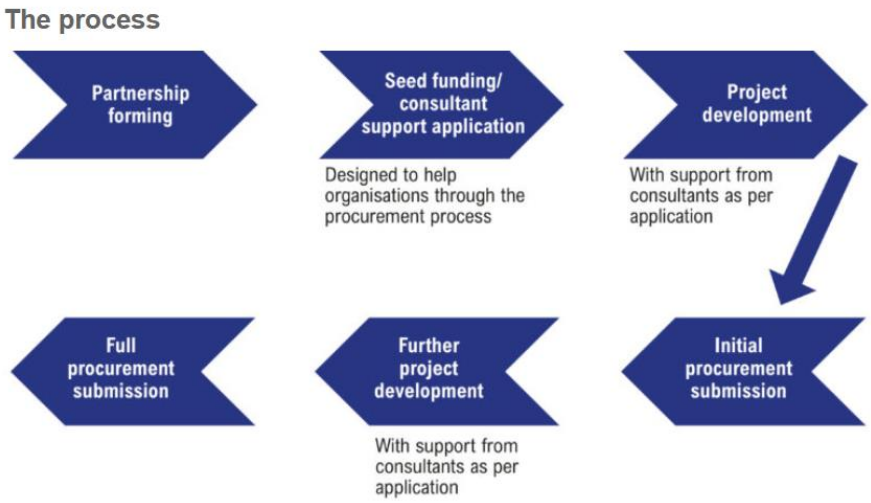
Currently flexibility services and platforms, such as in CMZ and the Piclo platform in the UK, are more and more being established across different markets. Up until now, however, predominantly large industrial and commercial end-users have increasingly been providing flexibility services but there is agreement that communities and residential end-consumers provide mostly untapped potential for flexibility. The role of communities in the energy transition and in providing flexibility services is therefore increasingly being implemented, investigated and explored through, for example the roll-out of local energy efficiency measures in communities, as well as trials and projects to increase learnings from flexibility platforms and community engagement with the goal to facilitate large-scale adoption of community flexibility.

To investigate the participation of communities in the UK, NEA and SSEN have designed a new classification of Social Constraint Management Zone (SCMZ), known as **Community Flex**, where local organisations are encouraged to develop community-based projects to address local network issues whilst investing benefitting communities. The potential and engagement of communities to provide CMZ services in exchange for remuneration is analysed in the "SSEN Social Constrained Management Zone Project" (SSEN SCMZ). This report summarises the processes and learnings from this project.

The SCMZ project undertook a stream of stakeholder engagement in local communities which will aid smaller community organisations to take part in the CMZ process, starting with two initial trial areas of Drayton and Coxmoor Wood. This is a first trial project to generate insight and learnings from experience with Constrained Managed Zones (CMZ) services provided by communities (*community flex)*. The goal is to ultimately engage community demand side flexibility more widely to manage local demand, storage and generation in those areas to avoid capacity constraints, e.g. mitigating peak load on a neighbourhood substation or mitigating peak infeed into the grid by consuming or storing locally produced energy. Avoiding capacity constraints in the network could help to defer expensive network investments that would otherwise be required.

Socially constraint managed zones

The aim of the SCMZ trials is to provide an easily accessible route for 'communities' in the Coxmoor Wood and Drayton areas to receive benefits for reducing peak demand by time shifting electricity consumption or reducing overall demand. Communities include local community and residents' groups, local authorities, registered social and private landlords, local businesses and business networks, as well as those organisations already in the energy efficiency and flexibility market. The project aims to provide a platform to match consumer groups and product providers. Examples of possible suitable projects are any solution that reduces or shifts demand, but examples might also include programmes of installation of LED lighting, battery storage or utilising variable rate electricity tariffs. The SCMZ project in the two trial areas is set up with the process as illustrated below;



Extensive stakeholder engagement took place in both trial areas to encourage community participation and match making for project developments. The key learnings from the stakeholder engagement process are:

- To improve information transparency;
- To improve support on technological details;
- To manage expectations on project financing; and
- To improve to project matchmaking process.

One project instigated through the SCMZ proceeded through the PQQ and ITT stages of the procurement, its submission is currently being evaluated for suitability by SSEN.

BAU approach and key learnings

SSEN expects to integrate SCMZ into its expanding portfolio of congestion management solutions and use it to procure local flexibility, where appropriate, alongside the established CMZ process for large distributed generation providers.

To achieve this, the barriers for entry will need to be adjusted based on the key learnings from the project.

- As flexibility volumes that can be delivered by community organisations, local businesses and other local providers are typically small, the threshold for participation will be lowered to 50kW

- The target communities and organisations for participation in SCMZ are often new entrants to (local) flexibility markets, or to the energy sector altogether. To successfully unlock the potential of flexibility, formal requirements for participation should reflect this and a basic level of support during the engagement is highly desirable.

- Contracted flexibility values have been low. To ensure an attractive business case for both flexibility providers and SSEN, the administrative burden of participation should be minimized and a clear path to larger deployments should be identifiable.

2 Background

This report is intended to provide an overview of the different stages in SSEN's and NEA's joint project on Social Constrained Manged Zones. It describes the background, experiences, learnings and next steps from the "SSEN Social Constrained Management Zone Project"[1] set up by Scottish and Southern Electricity Networks (SSEN) together with National Energy Action (NEA). The project involves engaging communities and community organisations to provide and engage in energy efficiency measures and demand side flexibility programs in exchange for payments to help alleviate local network constraints in selected Social Constrained Managed Zones (SCMZ). This is a first trial project to generate insight and learnings from experience with Constrained Managed Zones (CMZ) services provided by communities (*community flex)*. The goal is to ultimately engage community demand side flexibility more widely to manage local demand, storage and generation in those areas to avoid capacity constraints, e.g. mitigating peak load on a neighbourhood substation or mitigating peak infeed into the grid by consuming or storing locally produced energy. Avoiding capacity constraints in the network could help to defer expensive network investments that would otherwise be required. The figure below illustrates how flexibility measures could help to reduce or shift peak load to avoid capacity constraints. Peak load usually occurs in Great Britain on winter evenings depending on location and local impact of industrial consumers.

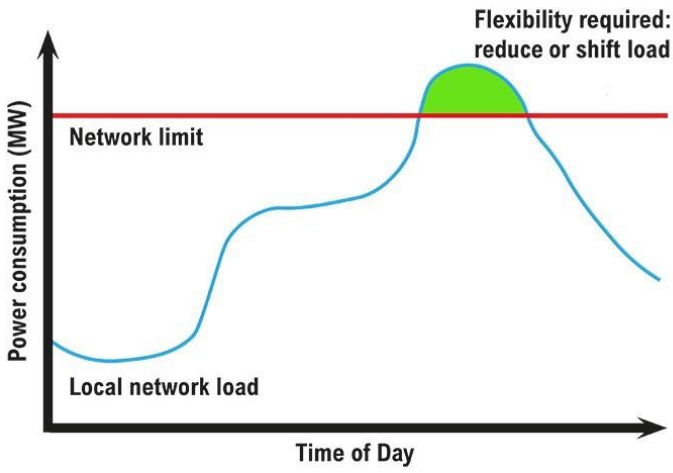


Figure 2-1: Illustration of required flexibility to reduce or shift load to stay within the network limit (Source: NEA[1])

Constrained Managed Zones

Constrained Managed Zones (CMZ) are geographical areas served by an existing distribution network but with potential needs for network reinforcement in the near future to deal with local capacity constraints. In these designated areas, a tender process is opened to procure flexibility services to defer network investments by reducing or managing demand from consumers in the area.[2]

[1] NEA, SSEN Social Constraint Management Zone Project, 2019. https://www.nea.org.uk/technical__trashed/scmz/
[2] SSEN, SSEN opens Constraint Managed Zone procurement process, 2016. http://news.ssen.co.uk/news/all-articles/2016/12/ssen-opens-constraint-managed-zone/

As stated in the CMZ project details on ENA's smarter networks portal[3]:

"SSEN have identified and released 5 CMZs to date, all structured around reinforcement deferral where the net present value (NPV) of postponing reinforcement over a 4-6-year term provides the overall value of the service provision. To date, tender responses received from CMZ type procurement exercises have largely been from large scale industrial and commercial (I&C) customers such as energy storage providers. Whilst, there has been an appetite from smaller community led initiatives to become involved in CMZs, this has proven to be challenging for them due to the burden of conforming with the requirements of an Official Journal of European Union (OJEU) procurement exercise and commercial barriers in place to protect the business such as Achilles registration. In addition, SSEN's current tender assessment process does not consider the wider societal benefit of a community providing the flexibility, generation or efficiency of a CMZ service. Although SSEN has established a clear case for communities and local organisations providing services to a distribution system operator (DSO), local groups are currently behind the curve in understanding this business case and as a result need assistance to commit to the concept. In short, the market place at a community level needs assistance and stimulation."

The SCMZ project

Next to the existing CMZs, a newly designed classification of Social Constraint Management Zone (SCMZ) has been developed, known as **Community Flex**, where local organisations are encouraged to develop community-based projects to address local network issues whilst investing benefitting communities. The potential and engagement of communities to provide CMZ services in exchange for remuneration is analysed in the SCMZ project.[1] The "SSEN Social Constrained Management Zone Project" (SSEN SCMZ) provides a stream of stakeholder engagement in local communities which aids smaller community organisations to take part in the CMZ process, starting with two initial trial areas of Drayton and Coxmoor Wood;[1]

- The **Drayton area** is needing up to 5 MW in CMZ services to cover peak demand times during the early evening on weekdays in November. These services might be required during about 6 events per year.
- The **Coxmoor Wood area** is needing up to 3.5 MW in CMZ services to cover peak demand times between December and February in the late afternoon and evening. These services might be required during about 6 events per year.

The SCMZ project supported these two communities in exploring options to participate in community flexibility CMZ services. The project aimed to[3]:

- Reducing barriers for small community groups to participate in the (Contract & Supplier Management) CSM tender process by:
  - supporting to submit tender responses to the ongoing procurement process for the CMZ zones in those locations only (SCMZ Delivery Document),
  - producing documentation that will aid smaller community groups in understanding the process and requirements of the SCMZ process, and
  - providing direct support to interested providers in the Drayton and Coxmoor Wood areas, through seed funding and/or consultant support.
- Determining the internal processes required for a future rollout of SCMZ to encourage community participants in other CMZ areas by:

[3] ENA – Smarter networks portal, Social Constrained Managed Zones, 2019. https://www.smarternetworks.org/project/nia_ssen_0036

  - working with legal, planning, regulation, CMZ and procurement teams to design processes for the trial which pass approval from all these internal teams and work on the documentation of a longer-term process, to allow for the replication of this process in other areas, and
  - gaining approval for use of these processes for (business as usual) BAU application.
- Determine a method for calculating the social and environmental benefits of SCMZ provider participation to include in network planning decisions in future by:
  - working with BEIS (Department of Business, Energy and Industrial Strategy) and Ofgem on calculations and approval, and
  - identifying a method for accounting for the social and environmental benefits for the SCMZ providers participation.

The SCMZ project aims were achieved through the following:

- An initial event was organised in each of the two geographical areas to gain information and opinions from the community groups about the project and the CMZ process.
- A stakeholder engagement research piece was written in collaboration with National Energy Action (NEA) to identify the correct groups and methods of engagement.
- A materials pack was developed to share with community groups
- A suite of internal processes for simplified legal and procurement documents were set up for use with smaller community groups.
- An informative workshop with community groups interested in providing SCMZ services was held.
- Support was provided to community groups in the form of an option of seed funding or SSEN funded consultancy support to aid the production of procurement documentation and (Pre-Qualification Questionnaire and Invitation to Tender) PQQ/ITT submissions.

The SCMZ project has potential for learnings to be shared among the GB DNOs (distribution network operators). The immaturity of the flexibility market is a major blocker to the utilisation of flexibility in managing distribution related constraints and this project progresses the understanding of the market and how to advance its maturity within smaller organisations. The project explores mobilisation of dormant flexibility within an area and will maximise the likelihood of affordable flexibility being available to DSOs. This includes: opportunities, barriers to entry and recommendations for further market stimulation in the future. In addition, the learning associated with the quantification of societal and environmental benefits[4] allows for understanding of the wider impact and benefit of expanding the flexibility and DSR marketplaces.

There will be two main documentation outputs from the project which will be shared between the DNOs are:

- **SCMZ 'delivery document'** (outlined process), which is this report. This document will enable the replication of the process within BAU (business as usual) implementations of SCMZ in wider zones, without the need for additional resource. It will also be accessible for other DNOs and industry partners once completed and successful as an example of best practice.
- **SCMZ 'Index' document**[4] is a brochure discussing flexibility and energy efficiency to be utilised in future BAU implementations of SCMZ and circulated as an example of best practice among DNOs, ENA, industry partners and potential SCMZ communities.

[4] NEA/SSEN, Community Flex - Flexibility and energy efficiency catalogue, 2019.

Flexibility and communities

Our energy system is undergoing monumental changes that result from three main drivers:

- the depletion of fossil fuels in the mid- and long-term,
- the desire for energy independence from (supra)national to local levels, as witnessed by the EU's "Energy Union" initiative and the rise of local sustainable energy initiatives across the UK, and
- the need to strongly reduce emissions to limit climate change, which is already being felt around the globe, and curb air pollution.

The rapid increase in renewable energy generation that has been one of the more prominent and visible changes of this, has prompted a strong electrification of the energy system, as most of the renewably generated energy comes in the form of electricity, and conversion is typically not economically viable. Transportation and space heating are the two sectors that are expected to generate the largest amount of new electricity demand in the coming decades as we switch to electric vehicles and replace oil- and gas-fired heating systems with (hybrid) heat pumps that rely predominantly on electricity for heat generation.

The changes in supply and demand impact the power system. More (peak) capacity is needed and operability becomes more challenging due to the intermittency from (distributed) resources, causing reverse power flows and balancing challenges at ever shorter time scales.

Poles and wires investments at the distribution level in the network are currently made to ensure that local peak demand is met. As more and more renewable energy sources, storage, electric vehicles and smart home appliances, such as smart washing machines, are being integrated at the distribution level in the system, flexible resources are required to deal with uncertainty, peaking and variability in supply and demand.

Network investments can be partly deferred or avoided through energy efficiency and flexibility. Reducing energy consumption and infeed, in particular at peak times, will namely reduce capacity needs of the distribution and transmission systems. Measures aimed at reducing the heating demand of homes are a prime candidate for this since the majority of a consumers' energy consumption is for space heating. Domestic energy efficiency and saving measures through efficient building materials and appliances are typically provided to consumers by an Energy Service Company (ESCo).

Consumers and communities can also play a key role in enabling the energy transition and supporting various stakeholders, including the DNO, by providing flexibility, either through energy savings and efficiency measures or through demand response. Two distinct types of demand response exist:

- *Implicit Demand Response* exposes customers to variable energy or grid tariffs, e.g. Time-of-Use (ToU) tariffs, that incentivise them to shift their load and/or generation to periods with low energy or electricity prices.
- *Explicit Demand Response* provides customers with (financial) rewards for agreeing to respond to requests to adjust their load or generation profile to support, for example, congestion management.

Flexibility or demand response can be provided by controllable assets like electric vehicles, home batteries and heat pumps with thermal storage, and can take on various forms at the consumer side as illustrated in Figure 2-2.

Peak consumption can be reduced at certain times to mitigate network reinforcements or prevent local network overloading by, for example, switching off electric peak heating units, or by introducing **time-shifting** of electricity demand. Time shifting of demand reduces consumption at peak times and shifts this consumption to times with lower system demand through, for example, flexible EV charging. Overall **reduction of demand** can be achieved through for example energy efficiency measures, such as the installation of LED lighting equipment or behavioural changes.

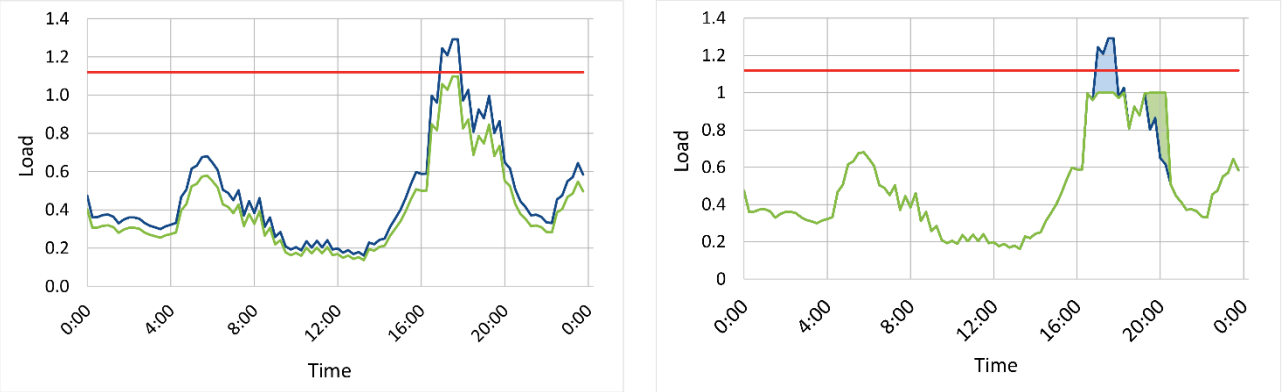


Figure 2-2: ***Examples of load reduction (left panel) through energy saving and load shifting (right panel) though demand response. Without community flex the load would temporary exceed the network limits. The expected load without any measures (blue lines) is adjusted using Community Flex to stay within the network limits (green lines).***

Currently flexibility services and platforms are being established across different markets. Up until now, however, predominantly large industrial and commercial end-users have increasingly been providing flexibility services but there is agreement that communities and residential end-consumers provide mostly untapped potential for flexibility. As emphasised by REGEN[5], consumer engagement and participation are crucial to achieve climate targets. By getting communities involved early on in the process, they can have a say in the design of markets that enable to unlock the flexibility they can provide, as well as ensure that communities benefit fairly from the services they would provide. In addition, consumers are also keen to be involved in providing flexibility to the energy system to help address climate change by energy saving measures and the integration of renewables in return for financial benefits. Consumers can ensure their market participation by using an *Aggregator*[6] or by establishing a *Citizens Energy Community*[7].

The role of communities in the energy transition and in providing flexibility services is therefore increasingly being implemented, investigated and explored through, for example the roll-out of local energy efficiency

[5] REGEN, Why should communities care about flexibility?, 2019. https://www.regen.co.uk/why-should-communities-care-about-flexibility/; REGEN, Power to participate: a specification for community energy to participate in a flexible energy system, 2019. https://www.regen.co.uk/wp-content/uploads/P2P-Specification-for-community-energy_Sept19.pdf

[6] Role or entity to collect and sell customer flexibility to market parties like the DNO.

[7] EU Clean Energy Package: legal entity which is based on voluntary and open participation, effectively controlled by shareholders or members who are natural persons, local authorities, including municipalities, or small-and microenterprises.

measures in communities, as well as trials and projects to increase learnings from flexibility platforms and community engagement with the goal to facilitate large-scale adoption of community flexibility.[8]

Within the US, for example, there is extensive experience of grid operators with "non-wire alternatives" (NWA), i.e. a combination of local energy efficiency measures, demand response, distributed generation and storage to defer network investments.[9] A large number of NWA programs, including programs at the end-consumer side, can be found in New York and California as their innovative regulatory frameworks allow (mostly vertically integrated) utilities to consider alternatives to traditional grid reinforcement. To increase interest in NWA programs, a benefit-sharing mechanism for the costs and benefits is required. For example, New York has developed a benefit-cost analysis handbook where NWAs can be used as part of the energy system transformation plan of the State.[9] **Southern California Edison** gained experience with NWA with its Preferred Resources Pilot[10] by procuring 200 MW of distributed energy resources (DER), also at the end-consumer level, by 2021 to meet growing load in the area and maintaining reliability.[9] A practical overview of US NWA and best practices has been developed by the Rocky Mountain Institute.[11]

Within the EU, the unbundling rules form a barrier for the implementation of NWA programs by network operators.[12] However, more and more community initiatives and flexibility platforms are being established with in Europe.

The Open Networks Project[13] initiative in the UK is facilitating the interaction between flexibility providers that offer resources to grid operators that are dealing with constraints in their networks. The initiative projected over 400MW each of demand side and generation flexibility to be procured through new market mechanisms, such as the Piclo[14] platform, by the end of 2019. In addition, community energy projects are also underway in the UK to explore flexibility, for example in

- the SAVE project[15], which aimed to assess energy efficiency measures for domestic customers across the UK as an alternative to traditional network reinforcement.

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[8] SSEN and Origami, Project Deliverable: TRANSITION - Analysis of DSO Flexibility Markets, 2019. https://ssen-transition.com/wp-content/uploads/2019/08/TRANSITION-Analysis-of-relevant-international-experience-of-DSO-flexibility-markets.pdf

[9] Energypost.eu, Non-Wires Alternatives for grid expansion: what the U.S. can teach Europe, 2019. https://energypost.eu/non-wires-alternatives-for-grid-expansion-what-the-u-s-can-teach-europe/; Navigant Research, Non-wires Alternatives Tracker 3Q19, 2019. https://www.navigantresearch.com/reports/non-wires-alternatives-tracker-3q19

[10] Southern California EDISON, Our Preferred Resources Pilot: Forging a New Approach to Using Clean Energy, 2019. https://www.sce.com/about-us/reliability/meeting-demand/our-preferred-resources-pilot; Southern California EDISON, SCE Preferred resources Pilot, annual report Q4 2018. https://www.sce.com/sites/default/files/inline-files/2019_PRP_AnnualReport.pdf

[11] Rocky Mountain Institute, The Non-Wires Solutions Implementation Playbook - A Practical Guide for Regulators, Utilities, and Developers, 2018. https://rmi.org/insight/non-wires-solutions-playbook/

[12] Energypost.eu, Non-Wires Alternatives for grid expansion: what the U.S. can teach Europe, 2019. https://energypost.eu/non-wires-alternatives-for-grid-expansion-what-the-u-s-can-teach-europe/

[13] ENA, Flexibility in Great Britain, 2019. http://www.energynetworks.org/electricity/futures/flexibility-in-great-britain.html

[14] Piclo flex, The independent market place for trading flexibility online, 2019. https://picloflex.com/

[15] SSEN, SAVE project, 2019. https://save-project.co.uk/wp-content/uploads/2019/09/SAVE-PPR-June-2019.pdf

- the Energy Wise[16] project that looks at a Big Lottery funded advice for energy savings to support households to reduce energy costs.
- and UKPN's energywise project[17] (also known as Vulnerable Customers and Energy Efficiency), which looked at energy efficiency and demand response for vulnerable customers.

In the **Netherlands**, the GOPACS[18] platform has been developed as a joint TSO-DSO market platform to address grid congestion.[9] It is the first European fully operational platform of its kind. It is no market platform itself but uses orders on existing market platforms, such as the intraday ETPA. Various initiatives of community flexibility markets through aggregators operating under the USEF framework[19] are also investigated in the Netherlands. The Energiekoplopers[20] project part of the DYNAMO innovation program of the Dutch DSO Liander, for example, demonstrates a local flexmarket following the USEF model where 203 households sold an average 0.92 kWh of flexibility per day. Other major markets are also experimenting with local flexibility platforms in pilot projects to address local bottlenecks, such as **Germany**'s SINTEG energy where new flexibility and digital distribution grid solutions are tested to help mitigating congestions.[9] The SINTEG programme recently showed a successful trade of local flexibility through the EPEX SPOT power exchange platform.[21]

In the **Australian** National Electricity Market (NEM), similar unbundling restrictions exists as in Europe. However, end-consumer flexibility is more and more being investigated to, amongst others, deal with network congestions due to peak summer demand. For example, the DNO Ausgrid runs the Power2U Program[22] that investigates several options for household flexibility provision through household energy efficiency measures, smart air-conditioning systems and a virtual power plant operation using household battery systems.

Selected high-level learnings and practices of the ongoing international flexibility initiatives at community level will be included throughout Chapter 4.

This report

The remainder of this report provides an overview of the current CMZ process in Chapter 3. Chapter 4 gives a detailed overview of the SCMZ project including some insights from international learnings and learnings from the SCMZ procurement process, with a consideration of the BAU and next steps for the SCMZ project given in Chapter 5.

[16] Community Energy Plus, Energy Wise, 2019. https://www.cep.org.uk/our-services/energy-wise/
[17] UKPN, Energywise project, 2018. https://innovation.ukpowernetworks.co.uk/projects/energywise/
[18] GOPACS, Grid Operators Platform for Congestion Solutions, 2019. https://gopacs.eu/
[19] Smart Energy Collective, An introduction to the Universal Smart Energy Framework (USEF), 2013. https://ec.europa.eu/energy/sites/ener/files/documents/xpert_group3_summary.pdf; USEF, Universal Smart Energy Framework, 2019. https://www.usef.energy/
[20] Energiekoplopers, Eindrapport fase 1 (2015-2016) & fase 2 (2018). https://www.energiekoplopers.nl/
[21] EPEX Spot, First trade on flexibility platform ENERA completed successfully, 2019. https://www.epexspot.com/en/press-media/press/details/press/First_trade_on_flexibility_platform_enera_completed_successfully
[22] Ausgrid, Demand management – Power2U Program, 2019. https://www.ausgrid.com.au/Industry/Demand-Management/Power2U-Progam

3 Current CMZ processes

SSEN's existing business process for identifying constraints and solving them through flexible smart grid solutions exists of five stages, ranging from identification to execution and involves nine business functions, including system planning, planning assurance, flexible solutions and procurement. The entire process is detailed in SSEN's internal "CMZ Process Flow 009" document and supported by detailed guidelines as specified in the internal "Constraint Managed Zones Scheme Guidelines for Planners" document. In this section, we briefly summarise the approach.

1. **Identification** – Potential congestion zones are identified by System Planning as part of monthly technical reporting, or as part of a connection driven study. Identification occurs up to 24 months ahead of the expected congestion challenge, ensuring sufficient time to explore flexibility and reinforcement options.
2. **Opportunity Assessment** – Flexible Solutions determines alternatives for reinforcement. As part of this CMZ feasibility is assessed and a business case for CMZ is produced. A Stage Gate Review subsequently confirms a CMZ approach or traditional reinforcement.
3. **Development** – In the Development stage, Flexible Solutions manages the CMZ bid process and interfaces with System Planning and Mapping Services to revise Site Technical Reports with CMZ parameters and create a Zone Map with Postcodes. These details are input to the (Pre-Qualification Questionnaire) PQQ process, managed by Procurement and supported by Legal. Evaluation of the PQQ results are used to update the CMZ business case. The Development Stage Gate Review then results in approval of the CMZ approach or a diversion towards a traditional reinforcement path.
4. **Refinement** – In this stage, Procurement prepares, runs and evaluates an ITT (Invitation to Tender). Through multiple steps a supplier is selected. The business case is updated to reflect the selected offering and approval is sought for the investment associated with executing the CMZ solution. When this is not approved, traditional reinforcement is pursued.
5. **Execution** – In the final stage of the process, Flexible Solutions is tasked with project managing the development & delivery of the solution, and a contract is awarded to the CMZ supplier by procurement.

Identified congested areas and their need for flexibility are visualised by SSEN on the Piclo Flex platform where flexibility providers can then register and compete to provide services with the CMZ areas.[23] SSEN has already utilised Piclo to secure flexibility for CMZ 6 sites.

This mature CMZ process is serving SSEN well in procuring flexibility to mitigate congestion. Flexibility in the CMZ scheme is typically provided by large Distributed Generation. In the SCMZ project, SSEN now looks to develop and test a similar approach for communities, leveraging aggregated energy savings and flexibility potential from residential and commercial customers. Unlocking local flexibility at the lowest voltages in the distribution grid enables SSEN to tackle congestion challenges at the source and provides further opportunity for reinforcement deferral. Although the process is expected to stay essentially the same, there are some key differences and consideration specific to SCMZ. These will be discussed in Sections 4.1 through 4.8.

[23] SSEN, Proactive Flexibility delivering Smarter Electricity, 2019. https://www.ssen.co.uk/SmarterElectricity/Flex/

4 SCMZ Project

The aim of the SCMZ trials is to provide an easily accessible route for 'communities' in the Coxmoor Wood and Drayton areas to receive benefits for reducing peak demand by time shifting electricity consumption or reducing overall demand.[24] Communities include local community and residents' groups, local authorities, registered social and private landlords, local businesses and business networks, as well as those organisations already in the energy efficiency and flexibility market. The project aims to provide a platform to match consumer groups and product providers. Examples of possible suitable projects are any solution that reduces or shifts demand, but examples might also include programmes of installation of LED lighting, battery storage or utilising variable rate electricity tariffs.[1] The SCMZ project in the two trial areas is set up as illustrated in Figure 4-1;

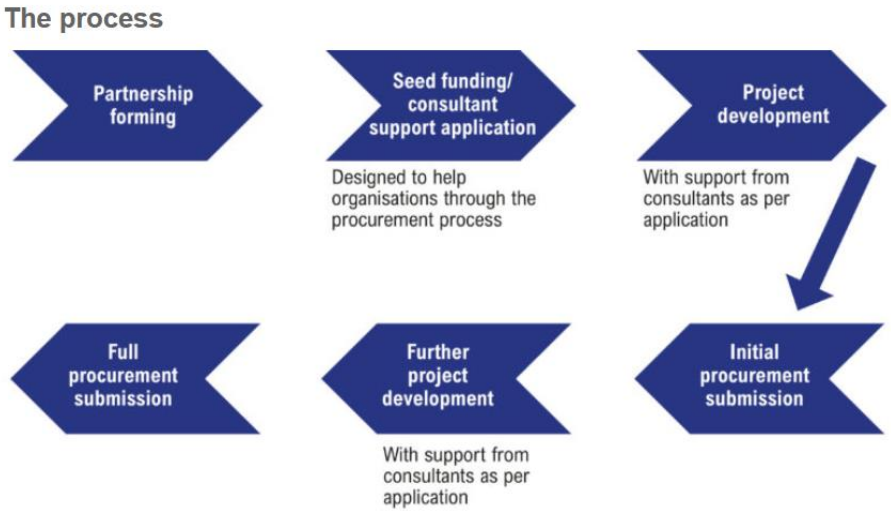

Figure 4-1: The different stages of the trial SCMZ procurement process (Source: NEA[1]))

1. *Partnership forming*: various stakeholder processes (see below) have been set up in both areas to inform community groups and create awareness for the SCMZ project. These stakeholder events also included a matchmaking workshop to facilitate partnerships between community groups and solution providers that could progress through the next stages in of the SCMZ process.

2. *Seed Funding Application*: each established partnership project could apply for Seed Funding through a small questionnaire. This Seed Funding can provide up to £2,550 in financial support, up to 16 hours of supporting consultant time or a mix of the two per project application and aims to assist with developing the project, completing the pre-qualification questionnaire (PQQ) and the tender process.

    - Each partnership is evaluated following a set of Seed Funding criteria to establish the amount of support applicable. The Seed funding criteria include a set of questions related to the type of business, the maturity of the project idea, the number of previous interactions with SSEN regarding connections, the availability and provision of technical support for the project idea

[24] NEA, SSEN Social Constraint Management Zones project #communityflex, Stakeholder Engagement Report, 2019.

and the capacity savings to be achieved by project idea. Each criterion is scored culminating in a total score per project idea. The available funding for each project idea is based on this score.

3. *Pre-Qualification Questionnaire (PQQ)*: With help of Seed Funding, projects can be supported to submit a Pre-Qualification Questionnaire that will assess if the project meets the requirements to participate in the Tender process for SCMZ services procurement in a later stage. The PQQ of the potential applicants is evaluated based on criteria[25] to select potential providers. A full PQQ needs to be submitted in order for projects to be considered eligible for the ITT stage. The questions are assessed base on three methods:

    - information provision,
    - pass/fail questions; any fail of the project eliminates it from the ITT
    - qualitatively or quantitatively scored/weighted questions. Each summitted PQQ is scored out of 100 and requires at least 50 out of 100 on these criteria. Any questions scoring 0 eliminate the project from the ITT.

4. *Invitation to Tender (ITT):* After a successful PQQ application, the project can be further developed using provided Seed Funding to prepare for the full procurement submission in the Tender procedure. The tender and contract procedure are stated on NEA[1]; "*Those who submit a tender will need to register on and submit through a procurement system called Achilles. Once the full tender is received, it will be reviewed alongside other submissions and then contracts can be agreed. Tenders will be assessed based on a number of technical, economic and social factors."*

The next steps[1] for the development of the project implementation after a successful tender application and once a contract has been put into place is the further development of the successful projects. Successful projects are expected to be operational by the end of March 2021. The exact timelines are to be agreed with SSEN on a project basis. During the development phase the project can be build or can be established through community and stakeholder engagement to identify the plan for further rollout.

NEA[1] also describes the operational phase of successful projects*:*

"Once the project is operational, SSEN will call upon the flexibility service when needed. It is likely there will be around 6 events in a given year, but there may be more or less depending on the local network demand. Flexibility services can be called on in a number of ways, from automatic dispatch of technology by SSEN, to phone calls and emails. It is expected that advance notice of potential service requirement can be given the day before. If the service is unavailable SSEN needs to be informed following the terms of the contract.

Once the services are delivered, validation is made through SSEN network monitoring and local data provided by the project (if available). Once validation has occurred payment can be made through the SSEN finance system as agreed by the contract. Payments dates have still to be finalised, but may be made after the end of each annual service window."

The initial timeline of the engagement and procurement process for SCMZ in the trial areas was quite ambitious as depicted in the below figure:[24]

[25] SSEN, PQQ Attachment 2 – Evaluation criteria (Reference FO-PRS-EMP-112), 2017.

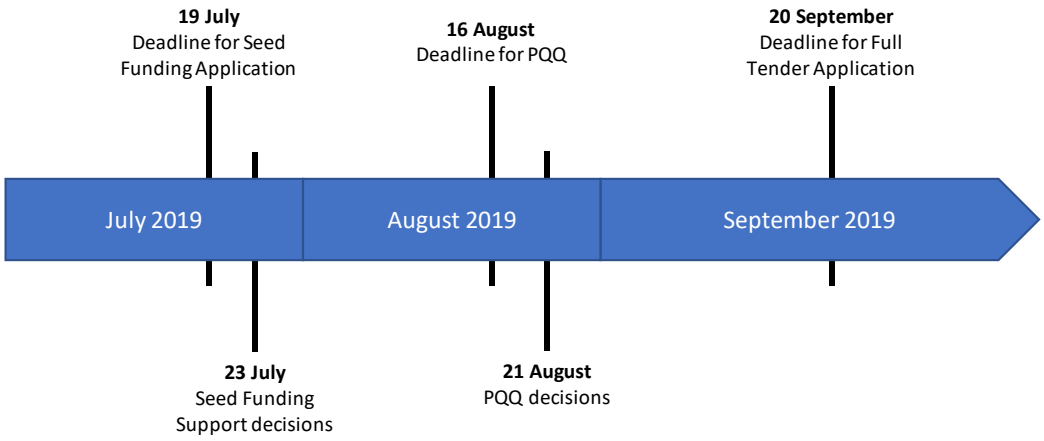

Figure 4-2: Initial timeline of the SCMZ process

The initial timeline of the project was extended after feedback from participants, who made it clear that they could not meet the tight timescales as originally planned.[26] This extension is mainly due to the nature of these organisations that typically have a long-term cycle for budgeting that does not allow much flexibility to invest in between budgeting rounds. After the first round of seed funding - to assist participants to develop projects and bids - had closed, a second round of seed-funding was opened, and the project deadlines pushed back. For future SCMZ projects, if the project were announced earlier in the process, potential participants could start to develop longer-term ideas – this may enable a wider range of types of partners to take part e.g. councils which make decisions via the lengthier democratic process.

As a result of the feedback, a second round of Seed Funding Applications was planned through August, shifting the PQQ deadline towards September and the Tender Application to end-December:[1,26]

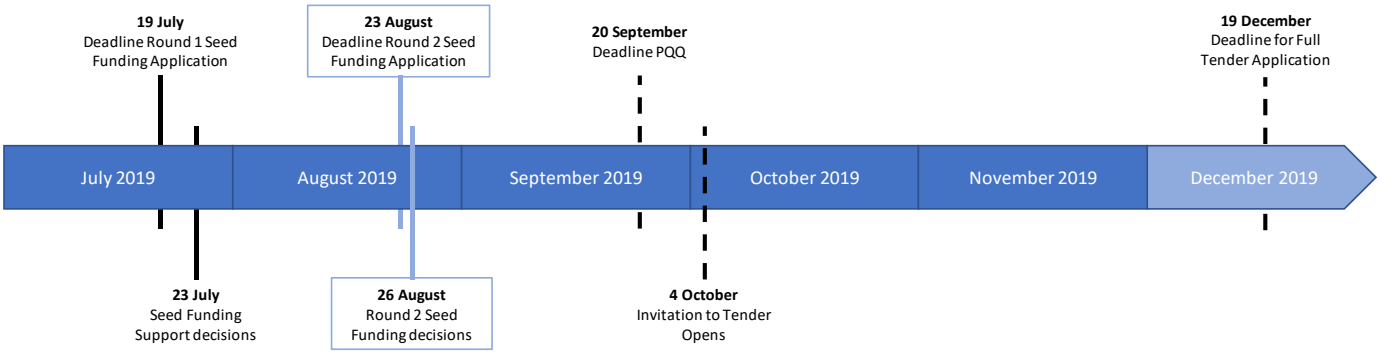

Figure 4-3: Extended timeline of the SCMZ project after stakeholder feedback

As detailed in the report on Stakeholder engagement activities undertaken under the SCMZ project[26] and cited; "*SSEN and NEA wanted to work with interested parties to develop proposals to ease constraints on the local electricity network. An engagement plan was developed which set out the steps involved in identifying and*

[26] NEA, SSEN Social Constraint Management Zones project #communityflex, Stakeholder Engagement Report, 2019.

motivating those organisations which could potentially develop such proposals to take part. This was done by relevant and timely contact via direct methods, press releases, social media and targeted mail-outs if required. This plan had to adapt to changing / newly identified project or stakeholder needs."

Ongoing stakeholder engagement activities were planned throughout the project as cited in the Stakeholder report:[26]"

- *raise awareness of the project, its purpose and resources available to support local organisations to engage and explore a potential project,*
- *assist in the development of potential projects,*
- *encourage attendance at the main stakeholder "match-making" workshop, and*
- *where required, support organisations through the application process."*

Stakeholder activities, as indicated in Figure 4-4 and Figure 4-5, ranged from webinars for interested and registered attendees and signposting by local agencies, to direct email mailouts and telephone engagements as well as advertising, social media posts and face-to-face meetings as indicated in the Engagement plan overview[26]. Materials about the project were developed for information and publicity – many were developed during the project period. Feedback was gathered throughout the process, in individual conversations with organisations before and after the workshop, and through feedback forms completed after the workshop.

Figure 4-4: Customer journey through application process (Source: NEA[26])

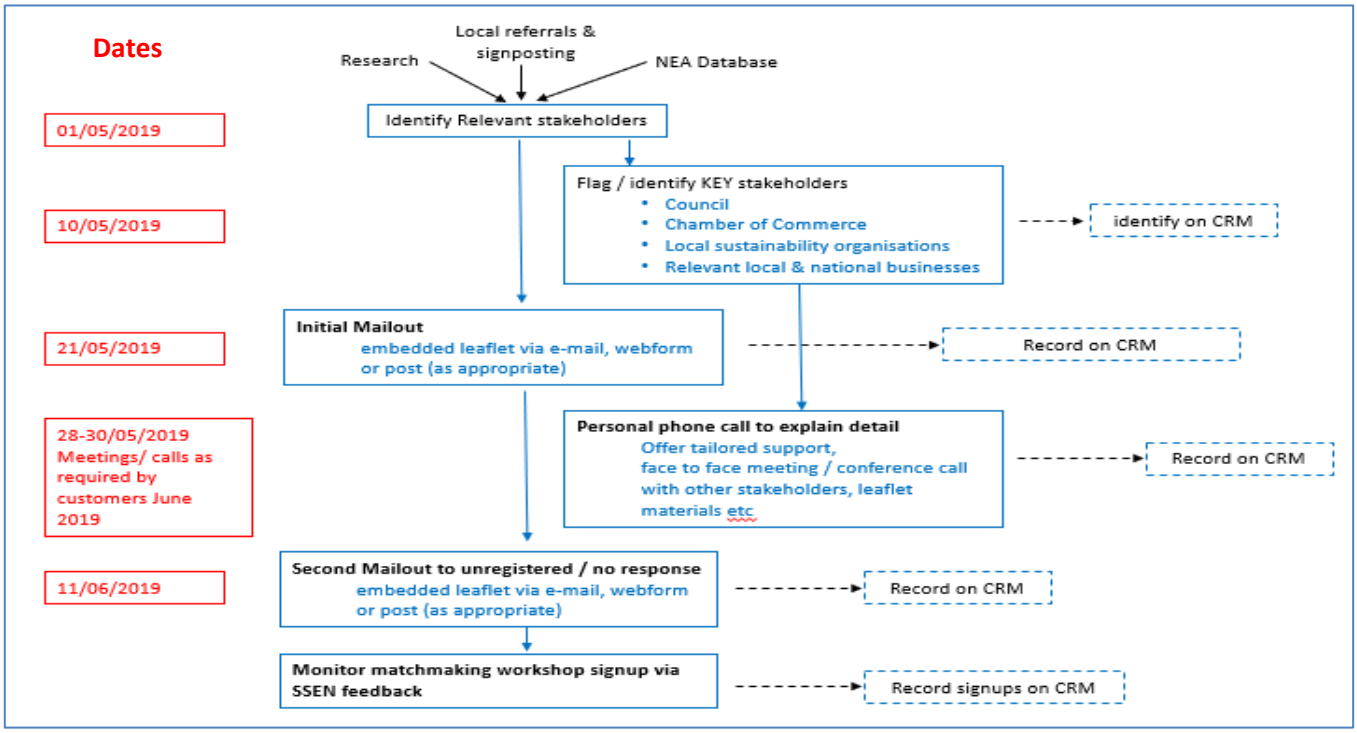

Figure 4-5: Customer Engagement Plan overview (Source: NEA[26])

The key learnings from the stakeholder engagement process are: [26]

- **Improve information transparency**; Participants required all information about the project – including payment levels – to be agreed and publicly available before commencement of the project, so they can decide whether to take part. The match-making workshop could then focus on forming partnerships to carry out the work, with a period in between for organisations to develop ideas.

- **Improve support on technological details**; Many smaller community groups or energy advice delivery organisations felt that they don't have the knowledge / capacity to (wish to) know all the details regarding flexibility provision. Also, small non-constituted bodies would need to partner with a larger organisation which are in the capacity to sign a flexibility contract.

- **Manage expectations on project financing**; Concerns revolved around the financing of the project, which some organisations felt may be too marginal for them to consider participating. Expectations must be managed to ensure delivery partners are aware from the outset that this funding is to improve the business case for a project, but the majority of funding will need to come from other sources. Worked examples would help to spell out to potential participants the scale of funding they might receive for different types of project.

- **Improve matchmaking process**; Some large technology manufacturers / suppliers were not confident to find local delivery partners. An aspect to consider for further development might therefore include to receive agreement from potential partners to share their details with other interested partners so they can contact each other to develop potential partnerships, whether or not they had been able to

attend the matchmaking workshop. At the time of writing, extra roadshows have been organised and carried out in Hook and Didcot, to encourage more local delivery partners to find out more about the project, potential technologies, and to get involved.

4.1 Procurement

The procurement process of the CMZ has been detailed in Chapter 3. These steps in the procurement process are also applied for the SCMZ procurement process. The main feedback of participants was that the contract should be simple to understand for community flexibility providers. In addition, there is a need for a standardised CMZ contract across DNO's. This is currently being developed at the Open Network Project.

Different procurement processes for community flexibility can be identified in the international context resulting in key learnings. Within Europe, the USEF framework[19] delivers a universal framework for the design of flexibility markets to facilitate the trading and commoditisation of energy flexibility as well as the architecture, tools and rules to operate smart energy systems that is compatible with most European market designs. The USEF framework is being validated and improved throughout a number of large-scale demonstration projects to commoditise flexibility products and services.[27]

In the Netherlands there are already five USEF demonstration projects under development with thousands of residential and small business end-users. With the USEF framework, procurement of flexibility services is established through a bilateral market between aggregators and balance responsible parties. In most trials this is currently a single aggregator with the view that this will develop further towards a multi-lateral market in the long term. For example, the Energiekoplopers[20] project in the Netherlands that demonstrates a local flexibility market following the USEF model where 203 households sold an average 0.92 kWh of flexibility per day, learned that for successful procurement of flexibility, the following conditions ideally should be met:

- The Aggregator needs to have a compelling story – the proposition must be easy to understand and resonate with customers' drivers, be they sustainability or financial gain or a desire for community-powered initiatives;
- Convenience is key: consumers do not want to spend any extra time or effort on providing flexibility;
- The proposition should not incur any extra costs – customers value financial security and prefer receiving a fixed compensation over dynamic tariffs/per event renumeration;
- Trustworthiness and reliability of the organisation that offers the proposition is very important.

Various initiatives at the end-consumer level are also ongoing in Australia, driven by challenges of system reliability coupled with significant peak demand throughout summer. These initiatives look mostly at controllable and smart appliances and battery storage to provide reliable and cost competitive sources of demand reductions or voltage support services to avoid or defer network investment. One notable project is Ausgrid's Power2U VPP project[22]. The trial includes 233 customers in 170 suburbs across their network service area who can participate with their existing behind-the-meter residential battery system to form a 1 MW/2.4 MWh virtual power plant. The VPP services are supplied through a registered demand response market provider to the DNO Ausgrid. The aggregator provides dispatching software for the batteries and customer interaction. 97% of the aggregator's customers in Ausgrid's network area joined the VPP, indicating an exceptionally strong interest in the VPP.[29] Only 3% of customers opted out during the trial. The customer service, ease of the process

[27] USEF, USEF in action, 2018. https://www.usef.energy/implementations/

and payment scheme showed to be main reasons of the high interest and support by end-consumers. The trial will be upscaled in the near future in a second phase by providing more choice in aggregators and opening up the scheme to more customers.

In the US, non-wire initiatives at the consumer-side to defer network investment and maintain reliability are more established.[9] However, no single standard procurement model exists. The leading procurement models include auction schemes, open solicitation based on a request for proposal, procurement with implementation contractors and internal utility resource deployment. The states of California and New York are most mature in their programs.

Con Edison, for example, has a grid investment deferral project in New York (Brooklyn Queens Demand Management)[28] that looks at the uptake of energy efficiency, demand response and distributed generation with a goal to saving 52 MW of peak load in the area from industrial, commercial and residential consumers. These measures were procured through energy auctions in addition to requests for proposals. The project learned that to ensure targeted savings, enough customers need to be engaged and a diverse set of technology solutions is required to cater to different consumer types.

In California, Southern California Edison runs its Preferred Resources Pilot[10] where the goal is to procure 200 MW of NWA by 2021.[12] Currently procurement activities are mainly completed and were conducted through Requests for Offers (competitive solicitations) as well as business and residential customer programs in existing programs and region-specific programs. The main learnings for the procurement process where[10]

- to limit similar product offerings to the same customers,
- to allow time for developers to do a market assessment,
- competitive solicitation as procurement process showed benefits of including an innovative and broad pool of measures, and
- the adoption of customer programs increased the speed of delivery of NWA options.

4.2 Payment Options

The payment options for SCMZ flexibility services are detailed in the SCMZ project index deliverable[4Error! Bookmark not defined.] as: "*SSEN can predict the level of flexibility needed and the times when it might be required for the area of the electricity distribution network under consideration. For example, in the Drayton zone, up to 5 MW of flexibility needs to be available on weekdays in November between 16:30u and 18:10u. There are a few days per year when this flexibility will be utilised. The network operator can predict these in advance and notify flexibility providers about when they will be required – this can be through smart technology, or through emails or text messages. Usually constraint events would be on weekdays.*"

The contracts for Community Flex are usually for 4 years. There are 3 different types of contract available[4]:

- *Utilisation only:* The provider is paid on a per-event basis when the flexibility is provided and used.
  - Best suited to behavioural signal projects
- *Availability only*: Payments are made for flexibility during the tendered time-window (whether or not a specific network constraint event occurs).

[28] ConEdison, Brooklyn Queens Demand Management Demand Response Program, 2019. https://www.coned.com/en/business-partners/business-opportunities/brooklyn-queens-demand-management-demand-response-program; BQDM quarterly expenditures & program report, Q4-2018. http://documents.dps.ny.gov/public/MatterManagement/CaseMaster.aspx?MatterSeq=45800

- Best suited to energy efficiency projects

- *Traditional mix – both Availability and Utilisation*: Here payments are made both during the specific network overload / constraint event (utilisation), and for the periods when flexibility is normally required.
  - Best suited to traditional generation projects

For example, the table below shows payment levels for contracts for an example SCMZ. However, payment levels will be quite different for each SCMZs:

Utilisation Only

- £868/MWh, utilised for 1.6-hour events (Drayton)
- £638/MWh, utilised for 4.5-hour events (Coxmoor)

Traditional Mix (Utilisation/Availability Mix)

- Utilisation - £4963/MWh, Availability £150/MW/h (Drayton)
- Utilisation - £140/MWh, Availability £38/MW/h (Coxmoor)

Availability Only

- £33 per kW available (Drayton)
- £69 per kW available (Coxmoor)

Figure 4-6: Example payment levels for contracts in the trial site (Source: NEA[1])

All projects and social constraint management zone areas are quite different. SSEN's engineers will evaluate and cost every proposal on its individual merits, factoring in the electrical load saving required, the times of day and the number of times in a year that the reductions are forecast to be required, compared to the cost of upgrade works which would be required if SSEN replaced the equipment in the traditional way. This will allow partners to see the anticipated funding which may be available to a community organisation to develop a project.

In the international context, different types of payment schemes have been used. In the Dutch Energiekoplopers[20] project, the payment scheme between the aggregator and the end-consumers was selected together with the community participants. The main learnings from the project found that any financial barriers to participate in the flex market through e.g. the investment in smart appliances should be taken away. In addition, the end-consumers had the option to select either a fixed payment for providing flexibility of €5 per month or a variable payment depending on the performance of the system. However, the payment risk of the latter option was very limited due to all consumers receiving a basic *compensation* payment next to the two options, which ensured they would not lose money to the project. There was an almost 50-50 selection of payment type by the end-consumers. End-consumers favoured a total payment that is more transparent and provided clarity on how much they would earn. The option for a dynamic payment with the combination of manual activation of the flexibility by the end-consumers showed to be a barrier to the end-consumers.

In Ausgrid's Power2U VPP project[22] in Australia, end-consumers participate with their own battery and receive payments from their market provider for the energy they supply to the grid, which lowers their energy costs. How much customers earn depends upon the size of their battery system, their current retail tariff (flat or time-of-use) and the number of network dispatch events they participate in. Customers are paid per kWh of energy exported during each dispatch event. An example for a participating residential customer with a 10kWh battery has been provided by Ausgrid[29]: this customer could earn around AUD 90-135 per year if participating in 10-15 flexibility dispatch events. These dispatch payments are additional to the benefits they receive on their electricity bill due to the usual operation of their battery. A total of AUD 7800 in dispatch payments was paid to the end-consumers during four months in early 2019.[29] In the second phase of the project, the benefit on customer energy bills due to VPP dispatch events will be further studied. VPPs can also capture additional value streams to stack revenues, such as wholesale price arbitrage and network support. The DNO can directly compare the service and dispatch costs of the VPP program to other demand management projects that can be used for firm peak reductions on the network by not subsidising customer acquisition or platform development.

In the US, Con Edison's Brooklyn Queens Demand Management (BQDM) program[28] provided incentives and rebates for the installation of energy efficiency measures in homes and businesses, such as free lighting upgrades and smart thermostat rebates. Most of the measures are however not designed to be dispatched or to deliver specific load reduction or production but to achieve specific load shape objectives in the area.

In SCE's Preferred Resources Program[10] in California, customers are encouraged to participate in different schemes resulting in a lower energy cost through demand reduction or earnings through participation in automated schemes. The following schemes have been identified as cited from[30]:"

- *"Automated Demand Response: business customers may earn up to $300 per kW of pre-calculated demand response load reduction for installing technology that automatically reduces load during energy events.*
- *Summer Discount Plan: customers are rewarded for allowing their AC to be remotely shut off during select energy events that affect their area.*
- *Save Power Day: customers can earn up to $100 annually in bill credits for reducing usage during peak periods on designated days.*
- *Energy Efficiency Rebates: installing energy efficient equipment in your home or business*."

4.3 Available Solutions

The available measures vary in scope and nature and are detailed in the *Community Flex Demand Management: Example Options* brochure that can be obtained through https://www.ssen.co.uk/community/. Three different categories of measures can be distinguished:

- **Energy savings & energy efficiency** measures aim at reducing the energy consumption of participants by either upgrading appliances to more energy efficient ones, by locally generating energy or by

[29] Ausgrid, Ausgrid's Battery Virtual Power Plant – phase 1 summary, August 2019. https://www.ausgrid.com.au/-/media/Documents/Demand-Mgmt/DMIA-research/Ausgrid-Battery-VPP-Phase-1-Summary-Report.pdf?la=en&hash=36F140433051D45C2EB2823630A07665575BD17C

[30] Edison international, Preferred Resources Pilot – Providing Reliable Power from Clean Resources, 2014. https://www.sce.com/sites/default/files/inline-files/SCE_PreferredResources_english.pdf

reducing demand through improving the energy performance of buildings. Examples include fitting of LED lightbulbs, installing solar panels and wall insulation.

- **Implicit Demand Response** exposes customer to time-dependent incentives to encouraging them to shift electricity consumption to periods of reduced demand. This helps smoothen demand and reduce peak-load on the network. Examples are time-of-use tariffs and in-home optimization services with smart devices.

- **Explicit Demand Response** rewards customers for agreeing to respond to requests from the network operator to adjust their load or generation profile to manage potential congestion situations. Examples including event-driven power delivery from home batteries, shifting start times of smart appliances like dish washers and dynamic pre-heating of homes.

Some of the solutions explored in this project provide a combination of these types of measures, by for example combining energy savings with implicit demand response or add a behavioural change component to an energy savings measures to increase its impact and longevity. Table 4-1 lists the set of solutions considered for SCMZ and their attractiveness to the network operator.

Table 4-1: Solutions considered for the SCMZ project and their attractiveness to the DNO

	Measure Type			Contract Type			
Solution	**Energy Efficiency & Savings**	**Indirect Demand Response**	**Direct Demand Response**	**Utilisation**	**Availability**	**Traditional Mix**	**Attractiveness to Network Operator**
Domestic LEDs	X				X		👍👍
LED Streetlighting	X				X		👍👍👍
Commercial / Office LEDs	X				X		👍👍👍
Domestic Solar PV	X				X		👍👍
Loft insulation	X				X		👍👍👍
Cavity wall insulation	X				X		👍👍👍
Solid wall insulation	X				X		👍👍👍
Automation of heating controls	X				X		👍👍
Replacing electric showers	X	X			X	X	👍
Heat pump replacing peak rate electric heaters	X	X			X		👍👍👍
Leaflets and reminders	X	X			X	X	👍
Smart Apps for behaviour change	X	X	X		X	X	👍
Large domestic battery on a time-of-use tariff		X		X			👍👍👍

EV charging – delaying charge time		X		X			👍👍👍
Solar Battery		X	X	X			👍👍👍

4.4 Expected Network Impact

The short and long-term network impact of CMZ solutions critically depends on the local context in which they are deployed. Their attractiveness to network operators and other stakeholders should therefore be assessed on a case-by-case basis.

Energy efficiency solutions, for example, are predominantly contracted based on availability and include amongst others LED lighting solutions and home insulation measures whereas solution that include a storage component are likely to be contracted for utilisation only (see Table 4-1). Potential peak demand reduction ranges from to 6.9W per unit for domestic LEDs during peak times, to 1.2kW per household from delayed EV-charging. See the *Community Flex Demand Management: Example Options* brochure that can be obtained through: https://www.ssen.co.uk/community/ for some more worked examples.

Energy efficiency and saving measures are expected to contribute close to 50% of the total emission reduction of the buildings sector by 2050[31] and as such represent a sizeable savings potential, but as the electrification of space heat represents a large load-growth in itself, the effect of these measures is more one of dampening load growth and not stopping or reversing it. The same is true for demand response options in relation to peak reduction: they represent substantial promise for reinforcement deferral but as networks needs to be extended anyway to accommodate load growth, they are primarily seen as a temporary solution.

This means additional value streams from flexibility are often a necessary ingredient for flexibility providers to generate a positive business case post-reinforcement. Interaction between these value streams might represent uncertainty around the expected network impact.

To effectively gauge the effect of an intervention, now and in the future, a solid understanding is thus required of the planned and expected changes in the energy system at national and local scale as well as planned community developments. Internationally flexibility at the consumer side is envisioned for several network impact objectives:

- to defer grid investments and reducing peak capacity,
- to improve reliability, and/or
- to provide voltage support

In the Netherlands, the Energiekoplopers project[20] engaged households that sold an average 0.92 kWh of flexibility per day to help alleviate capacity constraints in the grid and to prevent power interruptions

[31] Navigant, 1.5C in Urban Areas – Contributing to the Paris Agreement through the transport and buildings sector, 2019.

An interesting effect of reducing consumption during peak times has been demonstrated in the successful Tempus Energy & Origin Energy project in Australia.[32] This project involved a trial in South Australia for flexible energy demand management through the installation of smart software at large I&C customers that shift non-time critical loads (such as air-conditionings) to hours where the power price is lower. Not only did software allow to shift more than 200 MWh of commercial and industrial load, it led to "significant savings" on electricity costs and emissions (some customers more than 20% reduction in carbon footprint) for customers as peak times often require more carbon intensive generators to be engaged. This trial was so successful its now been rolled-out nationally in Australia.

Within the Ausgrid VPP trial[29] in Australia, Ausgrid activates signals to customers' batteries via the customer's market provider software when an action is required. The VPP trial investigated whether a VPP can be used for peak demand reduction and voltage support. Within the VPP there is 1 MW capacity and 2.4 MWh energy engaged through participating customers.

Within the US, energy efficiency measures are undertaken and trialled to facilitate network investment deferral. For example, the goal of the Con Edison Brooklyn Queens Demand Management Project[28] was to defer the investment in a new substation of $1B equivalent to 52 MW peak load. In California, SCE's Preferred Resources Pilot[33] aimed to procure 200 MW of energy efficiency, energy storage, demand response and DER by 2021 to meet growing load and ensure grid reliability.

4.5 Value stacking

Flexibility providers can generate more revenue by engaging in *value stacking*: providing services to multiple parties in the energy system using the same flexibility providing assets. Different forms of value stacking are possible[34]:

- **In time**: providing services to different parties at different times of the day.
- **Pooling**: (simultaneously) activating one set of assets to provide one service, and another pools of assets to provide another service.
- **Double serving**: providing multiple services concurrently with one asset.

Examples of value stacking include the use of home or community batteries for providing grid services to National Grid supporting Firm Frequency Response (FFR) and using batteries to store excess solar generation for use in the evening.

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[32] Origin Energy, Origin to trial demand management with large customers, 2017. https://www.originenergy.com.au/about/investors-media/media-centre/origin-to-trial-demand-management-with-large-customers.html/; RenewEconomy, Origin to take demand management trial national, after "significant" success in SA, 2018. https://reneweconomy.com.au/origin-to-take-demand-management-trial-national-after-significant-success-in-sa-43714/

[33] Southern California Edison, Our Preferred Resources Pilot: Forging a New Approach to Using Clean Energy, 2019. https://www.sce.com/about-us/reliability/meeting-demand/our-preferred-resources-pilot

[34] Flexibility Value Chain – Update 2018, USEF Foundation, 2018.

Flexibility payments from the SCMZ program can be used together with other funding sources[35], such as Energy Company Obligation (ECO). Additional funding aims to improve the business case for projects. The flexibility payments can thus be stacked for each project. Multiple additional sources of funding and payment streams are available in the UK including funding for domestic properties, non-domestic properties, fuel poverty programmes for households, community buildings and community energy feasibility studies, battery energy savings for businesses, and the development of new technologies and installations.[35]

4.6 Monitoring, Dispatch and Settlement

4.6.1 Monitoring

CMZ services are typically delivered by large Distributed Generation providers, whose existing metering and telemetry is used to for monitoring dispatch and consequently for settlement. SCMZ solutions leverage a larger customer base with smaller per-user savings/flexibility, in potentially less monitored grid segments.

For SCMZ to be successful, monitoring of the low-voltage grid or 11/33kV substation metering needs to be in place well ahead of time of the deployment of any SCMZ measure to establish load and generation baselines. These baselines are needed to establish the level of delivery of flexibility savings. Existing half-hourly measurements from larger connections, e.g. from leisure centres, can be used where available to augment the monitoring.

Installation of monitoring can be achieved relatively quickly once it is clear that there is a sufficient market pull for providing (peak) load reduction services and the SCMZ procurement process needs to be extended to reflect this.

4.6.2 Dispatch

This SCMZ project explored energy savings and energy efficiency measures as well demand response options. Flexibility services with the SCMZ trial areas can be called on in a number of ways, from automatic dispatch of technology by SSEN, to phone calls and emails. It is expected that advance notice of potential service requirement can be given the day before. If the service is unavailable, SSEN needs to be informed following the terms of the contract. However, none of the explored measures in this project provides direct dispatch of flexibility. Dispatch is continuous but not constant, in case of lowered consumption from energy savings and energy efficiency, and incentive-based, in case of implicit and explicit demand response. Although in the case of incentive-based response dispatch cannot be guaranteed, it can be monitored in near real-time and pilots and international experience have shown there is a high level of predictability, provided there is a sufficiently large customer base.

For example, feed-back from residential customers in the Low Carbon London project from UKPN[36] favoured some predictability in time-of-use tariffs to increase participation. This also increased predictability of the load shifting and reduction on the network. A robust average reduction of 0.05 kW per household was

[35] NEA, Potential sources of additional funding for projects delivering Demand Side Response or energy efficiency savings through the SSEN funded Social Constraint Management Zones (SCMZ) project, 2019. https://www.nea.org.uk/wp-content/uploads/2019/08/Sources-of-additional-funding-for-installations.pdf

[36] UKPN, DNO Guide to Future Smart Management of Distribution Networks Summary Report By UK Power Networks & Low Carbon London Learning Lab, 2015. https://innovation.ukpowernetworks.co.uk/wp-content/uploads/2019/05/Summary-Report.pdf

demonstrated, with 0.08-0.22 kW for the most engaging households, concluding that ToU demand reductions are substantial aspects to be considered for future network planning. In addition, a strong correlation between reduction potential and the system demand was identified, increasing the reduction potential during peak demand periods above average levels. Demand response using dynamic time of use tariffs was statistically proven to be highly reliable for network constraint management: with a confidence level of 95% (confidence range 7.1-8.4%) a 7.8% peak demand reduction could be observed.

4.6.3 Settlement

Settlement with service providers will be periodic and based on actually delivered savings and/or flexibility. Metering and monitoring data from the network operator will be leading but can be augmented by data from the service provider. The service provider will be solely responsible for rewarding customers for participating in an SCMZ scheme. Note that these rewards can be financial or otherwise, one-time, periodic or event-driven, depending on the nature of the solution and the contractual arrangements between the solution provider and its end-users. Examples of such arrangements include:

- Flexibility aggregators paying a fixed fee to customers for the ability to control their smart appliances;
- Housing corporations that invests in Solar PV and tenants pay a small increase in rent but benefit from reduced energy bills;
- Energy companies subsidising home batteries in exchange for the right to use part of the battery's capacity to for delivering grid support services.

4.6.4 International examples

Under the Energiekoplopers[20] project, monitoring & dispatch was done as follows. A large dataset has been generated throughout the project originating from the installed smart appliances, household smart meters and during the trade of flexibility services. The household smart appliances were monitored every 5 minutes. In contrast, twice daily flexibility was traded on a 15 min interval (once at the day-ahead and once at intraday time frame). Based on the collected data from the smart appliances, the smart energy system started operating. First the smart IT system would predict the availability flexibility for each day. Consecutively, this amount was traded in the market. Finally, the smart appliances would automatically be dispatched to provide the flexibility. For the end-consumer there would be no loss of comfort. I the first phase of the project, the following appliances were considered 45 electrical boilers, 49 heat pumps, 95 solar PV switches and 14 fuel cells.

In the Ausgrid Power2U VPP[29]trial project, the DNO automatically activates signals to customers' batteries through their market provider to export stored energy to the grid. The participating batteries already had a battery energy system from the selected market provider that optimises household energy use based on its retail tariff scheme and possible solar PV generation. The market provider was selected as the VPP aggregator for phase 1 of the project due to their track record with residential battery control and dispatch, significant experience with R&D and demonstration VPP projects and their established customer base. To enable the identification of the typical impact or benefit of household batteries on the network without VPP operation, a good analysis of 'business as usual' battery operation is critical. Data from the inherent control units from the batteries already provided some insight in their dispatch patterns under flat or time of use retail tariffs but a larger customer base will be investigated in phase 2 of the project to improve patterns. In addition, to ensure that VPP dispatch events are optimised with respect to maximum demand reduction benefits to the network, accurate short-term forecasting of customer demand is necessary.

The Con Edison BQDM program and the New York Preferred resources pilot[30] focus on energy efficiency measures for residential consumers that adapt load profiles without dispatching. Under the Preferred Resources Pilot there is also the option for residential consumers to decrease demand during designated time periods in exchange for remuneration or to have their air-conditioning units switched off remotely during events affecting their area.

4.7 Risk and Mitigation

Depending on the location, SSEN can procure energy savings and flexibility services both as a temporary and as a long-term solution. In both cases, SSEN must be sure that a SCMZ project will deliver the (peak) load reduction required and that it can be relied upon for several years, similar to CMZ projects. Compared to current CMZ projects, SCMZ projects have a number of characteristics that result in a different risk profile;

- Energy efficiency & savings measures might deliver less savings than expected, i.e. due to reduced number of successfully upgraded buildings, underperformance of technology or rebound effects.
- Service delivery might deteriorate over time because customers uninstall devices, sell them, or because they break down and are replacing with something that does not perform as well.
- Flexibility aggregators and, to a lesser extent, Energy Service Companies, are newcomers to the market. Especially when run by local communities, such as in the case of a local energy cooperation, these organisations carry an increased risk of being less mature and less professionally run compared to incumbent energy companies and large DG-providers. Business continuity, and as a result service delivery, could therefore be a concern.

Planners include a “confidence factor” in their calculations as to whether savings are likely to be delivered and these risks for non-delivery could be mitigated by over-contracting. However, this worsens the business case for SSEN, aggregator, ESCo or end-user, depending on remuneration and risk-sharing model that is chosen and might impact the liquidity in the market and the viability of the SCMZ scheme.

To mitigate against fewer than expected savings, and service deterioration over time, a data provisioning commitment from the solution provider is needed together with remedial action plan for meeting commitments and providing back-up. These requirements should be identified and explored in the PQQ and ITT stages of Procurement and formalised in the supplier contract.

Financial penalties for non-performance should be included in the supplier contract too, but it should be noted that level of recourse with start-ups and small, local aggregators is not comparable with more traditional suppliers.

Network operators can help by actively identifying and communicating value stacking opportunities to suppliers. As is the case for CMZ, SSEN does not require exclusivity for SCMZ providers. They are required to deliver the contracted savings/flexibility for specified time windows (effectively excluding pooling) but are free to provide the services to other parties outside these windows by e.g. providing primary or secondary reserve power to the transmission grid using car or home batteries.[35] Value stacking is a win-win-win proposition, as it improves the business case for network operators, service providers and customers alike and provides greater liquidity to the market.

In the international context, the Power2U airco project[37] had the DNO Ausgrid install signal receivers in eligible residential air-conditioning in a trial area to automatically and remotely activated their load through a signal sent along power lines during a power saving model event. No overwrite from the signal by customers as possible whilst part of the program. This allowed for running air-conditionings to be fully available for the event. The trial is running to early 2020.

Key learnings from phase 1 of the Ausgrid Power2U VPP trial[38] in Australia involved further research in the requested, accepted and delivered dispatches to assess why the accepted energy dispatched did not match the requested energy dispatched although the dispatch is automatically activated. In addition, further analysis is required to understand the cause for non-delivered requested by each battery (e.g. due to communications failure, control algorithm, state of charge or other site-specific reasons).[38] This analysis would improve confidence levels in requested energy dispatched.

In the Energiekoplopers project[20] in the Netherlands, the aggregator plays the crucial role in the flexibility market as intermediary between the requested and delivered flexibility. The project showed that the aggregator was not always able to deliver sold flexibility. Approximately two-thirds of the required flexibility was successfully delivered using smart appliances or demand reduction of households. Key reasons for non-delivery of flexibility included IT malfunctions and inaccuracies in forecasted availability of flexibility.

In the BQDM program from Con Edison[28] a large portfolio of many different demand-side resources was considered, ranging from household energy saving measures to distributed generation and storage. Risk where mitigated as follows;[39] Verification of the load reduction provided by the different solutions was required to have confidence in the ability of the solutions to provide flexibility services. This was established through the design of a comprehensive measurement & verification approach together with the implementation of each solution. This approach also included onsite inspection and metering and analysis of collected data. The rationale behind this comprehensive approach is to establish 90/10 confidence and precision levels of saving estimates within each hour. The approach can be tailored to specific technologies or solutions. Currently, tailored customised metering and verification approaches are designed per traditional utility solutions. This in combination with, amongst others, desk reviews additional checks, metering, and analysis of billing. This is used to continuously ensure the confidence of the saving contribution of each solution and accurately combine the contributions of each solutions in a total saving. This approach in determining confidence will also be used to assist in the procurement strategy of solutions. Based on the approach also extensive quality assurance and control measures are being implemented to add additional

4.8 Learning from Procurement Process

Participants in the procurement process were interviewed about their experiences and perception of the project. The following key lessons were drawn from the interviews:

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[37] Ausgrid, Power2U Program: Save on your air conditioning, 2019. https://www.ausgrid.com.au/Industry/Demand-Management/Power2U-Progam/Aircon-Saver-Program

[38] Ausgrid, Power2U Program: Battery Virtual Power plant trial, 2019. https://www.ausgrid.com.au/Industry/Demand-Management/Power2U-Progam/Battery-VPP-Trial

[39] Brooklyn Queens Demand Management Program: Implementation and Outreach plan, 2019.

- **There are enough reasons for participants to join the tender:** The participants think it is a great program which is needed to boost innovation and new business models in GB. The participants are interested to explore further collaboration when the program is transitioned to BaU.
- **It was a challenging timeline for the participants:** Participants needed more time to align internally on offering such a new service or to find partners to co-develop and market a solution.
- **Improved communication can enhance participation:** more direct and quicker responses from a focused team would improve clarity on the process and help to sustain initial high levels of enthusiasm from participants.
- **It was difficult to register the new concepts in Archilles:** The environment of Archilles was not perceived as consumer friendly, but more importantly, the requirements that organisations were asked to register for participation were not tuned to the participants but rather geared at large Distributed Generation providers.

5 BaU Considerations and Next Steps

The following section provides an overview of how SSEN plans to incorporate the learnings from SCMZ into business-as-usual.

As described in this report, several organisations globally and locally have explored the value of customer flexibility in electricity network planning. Several of these projects have focussed on how large individual sites can impact the load profile of a substation and serve as a learning process for eventually LV rollout too. The SCMZ project set out to test the market maturity for community-based flexibility and community-based energy efficiency schemes to support network constraints.

The tested approach, although successful in attracting smaller flexibility and energy efficiency volumes to the market, was initially, as expected and planned, labour-intensive for SSEN during deployment. It is anticipated that the levels of support provided during the project are not sustainable in a business as usual environment. This is because the costs associated with the support would need to be accounted for by the flexibility provider (typically a community organisation, local business or nationally operating solution provider) and therefore significantly reduce the profitability of providing the service. As maturity of the market increases, the need for support is expected to reduce.

As highlighted in the project PEA document, the market-maturity for community-based flexibility & energy efficiency solutions is low. Although the SCMZ project has substantially informed communities about the value of flexibility, there remain some challenges associated with the affordability of the domestic technologies required to provide the level of monitoring, dispatch, and control required by the DNO. As the cost of these technologies reduces, SSEN expects the business case for community flex to improve for flexibility providers and DNOs alike.

Based on the proposed funding available from SCMZ, and the cost associated with the deployment of solutions, there remain significant gaps in funding required for community-based flexibility & energy efficiency projects. Based on this, SSEN will continue to explore whether additional benefits from flexibility, such as optionality, can be accounted for when assessing the value of flexibility and energy efficiency in the future. This additional benefit may increase the value of the service to SSEN and therefore provide a more attractive funding incentive for the communities. Based on feedback from stakeholders there are three key points for SSEN and other DNOs to consider when exploring flexibility & energy efficiency options:

- **Initial CAPEX** - SSEN recognises that the initial CAPEX required to set up the flexibility service can be a large hurdle for many smaller community organisations and local flexibility providers to participate in flexibility and energy efficiency schemes. SSEN recommends further collaboration across communities and financing institutions to inform, educate and facilitate future funding opportunities.
- **Additional Funding Streams** – Government level policy is required to clarify what additional funding streams may be available to support energy efficiency & flexibility in the energy transition. The social benefits associated with community-based flex and energy efficiency need to be considered as an integral part of the benefits; not just as an externality.
- **Technology Maturity** – The platforms and monitoring/dispatch systems associated with community-scale flexibility are still not fully mature and are not familiar to most communities.

Overall, SSEN recommends embedding community-based flexibility and energy efficiency projects into the CMZ process in the future. As a result, community-based flexibility & energy efficiency providers will follow the same process for bidding for flexibility as existing CMZ providers. The CMZ process will also allow community-based projects to stack revenues by offering multiple services and tapping into multiple funding schemes. The consolidation of the service products across SCMZ and CMZ ensures SSEN customers have a single route/entry point for providing flex / energy efficiency solutions.

Although there have not been many communities to date who have opted to provide services through SCMZ, SSEN will continue to engage with communities throughout the year through and monitor and track the interest of communities to engage in flexibility / EE provision. In future, when assessing CMZ areas, SSEN will determine what levels of support can be provided to communities based on the value the additional flexibility brings to the network. The materials (e.g. the Community Flex brochure) developed throughout the SCMZ project will be freely available to existing and future customers.

To increase the opportunity for communities to participate in flexibility markets, and based on stakeholder feedback during the SMCZ project, SSEN would lower the threshold for participating parties from 100kW to 50kW. SSEN will encourage communities to work with aggregators to enable the offering of larger flex volumes to DNOs in the future.

Throughout the stakeholder engagement process of SCMZ, we have recognised the importance of using simple and consistent terminology when engaging with potential customers. Based on this feedback and in alignment with Open Networks' recommendation SSEN will in the future use the following naming conventions for flexibility services (Prevent, Prepare, Respond & Restore).

- Prevent – SSEN's traditional CMZ product. Required to manage peak demand on the network, usually weekday evenings.
- Prepare – Required to support the network during planned maintenance work.
- Respond - Required to support the network during fault conditions as a result of maintenance work.
- Restore – Utilisation-only product, needed to support the network during networks faults that occur as a result of equipment failure.

The services provided under the SCMZ project would be procured under the Prevent service product.

Appendix A Index

1. Maps of SCMZ sites and participation overview: https://www.nea.org.uk/technical/scmz/
2. SCMZ overview video: https://www.nea.org.uk/technical/scmz/workshop/
3. SCMZ Workshop slides: https://www.nea.org.uk/wp-content/uploads/2019/07/SCMZ-MatchMaking-workshop-04.07.19.pdf
4. SCMZ seed funding application form: https://www.nea.org.uk/wp-content/uploads/2019/07/SSEN-SCMZ-Seed-Funding-Form.docx
5. SCMZ other funding support: https://www.nea.org.uk/wp-content/uploads/2019/08/Sources-of-additional-funding-for-installations.pdf
6. SCMZ promotional leaflet: https://www.nea.org.uk/wp-content/uploads/2019/08/Sources-of-additional-funding-for-installations.pdf
7. SCMZ FAQ's: https://www.nea.org.uk/wp-content/uploads/2019/08/FAQs-v3.pdf
8. SCMZ technology support Brochure: https://www.ssen.co.uk/community/