Emergent Energy Systems Ltd

BSC Sandbox Evaluation Report

Scheme name: Delivering the right to switch for residential customers on microgrids

Sandbox type: BSC Sandbox — Temporary derogation from the Balancing and Settlement Code

Sandbox reference: BSB001

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Date: 18.2.26

Emergent BSC Sandbox review for industry publication

Emergent Energy Systems Ltd was the first innovator to receive a BSC Sandbox derogation, and the first to complete the full journey from Sandbox trial to permanent regulatory change. BSC Modification P455 — 'On-site Aggregation as a method to facilitate Third Party Access' — was approved by Ofgem on 17 September 2024 and implemented on 24 September 2024. This report evaluates that journey and sets out what we have learned.

1. Background to the project

Introduction to Emergent

Emergent Energy Systems Ltd ("Emergent") establishes and operates microgrids within residential housing developments, primarily blocks of flats. These microgrids typically include solar photovoltaic (PV) generation and shared battery storage connected to a locally operated private network.

We partner with housing companies, including social housing providers and developers, to deploy these microgrid arrangements. The approach is designed to reduce the cost to housing companies of decarbonising their housing stock while lowering energy bills for their residents.

Emergent operates the microgrids as a licence-exempt electricity supplier under the Class Exemptions framework of the Electricity Act 1989, supplying residents with a blend of on-site solar generation and imported grid power.

Rationale for the Sandbox Trial

While the commercial success of residential microgrids depends in part on retaining on-site consumers and minimising exposure to off-site back-up and top-up power, Emergent has always recognised that the credibility of its model — with both housing company clients and residents — cannot be founded on locking consumers into long-term supply arrangements. Residents must be able to exercise their legal right to switch supplier whenever they wish.

The Electricity and Gas (Internal Markets) Regulations 2011, which transposed the requirements of EU Electricity Directive 2009/72/EC, established that consumers connected to private networks have a right to Third Party Access (TPA) — meaning they can switch to another supplier. This right has been in place for over a decade. However, the existing industry mechanisms for facilitating this switching process for domestic and small business consumers on private networks were, in practice, not fit for purpose.

Overview and aims of the proposed methodology

Emergent proposed trialling an “on-site aggregation” methodology as an alternative to the existing “difference metering” approach for enabling Third Party Access on private networks.

Under difference metering — the default BSC arrangement for enabling TPA — a third-party supplier (TPS) wishing to supply a customer on a private network must enter into bespoke contractual arrangements with the boundary point supplier and appoint the same metering agents (Half-Hourly Meter Operator Agent and Half-Hourly Data Collector) used by that boundary point supplier. Supply volumes for each supplier are calculated by deducting the switching customer’s volumes from the boundary point meter reading. This arrangement becomes increasingly complex (and costly) with each additional supplier on site.

Emergent’s proposed on-site aggregation methodology works differently. Rather than calculating supplier volumes by difference from the boundary point meter, aggregated data from sub-meters installed on the private network for those customers who have not switched is submitted into settlement in lieu of data from the site’s boundary point meter. Customers who switch to a third-party supplier have their meter data measured and submitted in the same way as customers directly connected to a Distribution Network Operator (DNO) network. This means each supplier on site is settled for the correct amount of consumed (or generated) electricity without needing bilateral arrangements with every other supplier on site.

The aims of the trial were to:

- Demonstrate that the on-site aggregation methodology produces settlement data of equivalent accuracy to difference metering.
- Show that the methodology is simpler, less costly and more scalable than existing arrangements.
- Provide evidence to support a permanent BSC Modification that would make this methodology available industry-wide.

Justification for the Sandbox application

Why did Emergent apply for a BSC derogation?

The on-site aggregation methodology required metered data from sub-meters on the private network to be submitted into settlement in lieu of data from the site’s boundary point settlement meter. This was not permissible under the existing BSC rules, which require that metered data for settlement be collected from a metering system at the interface between a premises and the total system (the boundary point).

We discussed the issue for some time with both Elexon and Ofgem, seeking a means to overcome the challenges we faced. As these conversations progressed, the Sandbox arrangements were introduced by Ofgem, and it was determined that a temporary

derogation from the requirement was a suitable approach to trial the methodology in a live market environment and provide credible data that could support its introduction.

Why was a Sandbox necessary for progressing the methodology?

The view taken at the time through our discussions with Elexon and Ofgem was that a BSC Modification to permanently change the rules would be significantly strengthened by first demonstrating that the on-site aggregation methodology worked in practice. The Sandbox provided a mechanism to conduct a time-limited, controlled trial in a live energy environment — generating the evidence needed to inform a subsequent Modification proposal with confidence.

What were the barriers preventing Emergent from introducing the methodology?

The barriers were threefold. First, the BSC rules required settlement data to be sourced from the boundary point meter or calculated by difference from it — there was no provision for aggregated sub-meter data to be used instead. Second, the existing difference metering arrangements imposed operational and contractual requirements on third-party suppliers that were disproportionately burdensome for domestic customers, effectively making TPA uneconomic. Third, without live trial evidence, the basis on which to propose a permanent code change was relatively weak — Emergent needed to demonstrate the methodology worked before the industry would consider adopting it.

Scope and scale of the project

The BSC Sandbox derogation permitted a trial of up to 2,000 consumers across a number of licence-exempt networks. In practice, the trial was quite a bit smaller, taking place across four sites in two locations:

Gateshead: One high-rise building comprising a private wire network with a combined heat and power (CHP) system.

Nottingham: Three low-rise blocks of flats, each with solar PV systems installed, serving approximately 57 end customers in total.

Together, the sites included approximately 165 customers who were supplied by microgrids (108 in Gateshead and 57 in Nottingham).

At the point the trial commenced, a significant number of customers at these sites (c.80) were not connected to Emergent's systems and were already receiving supply through a third-party supplier.

However, the settlement volumes for these third-party-supplied customers were not being deducted from the values measured at the boundary point meters, resulting in inaccurate settlement data. The application of the on-site aggregation methodology corrected these settlement values so that boundary point meter data reflected only the netted usage of on-site generation and load for participating customers, excluding volumes consumed by customers supplied by third-party suppliers.

The BSC derogation was formally granted by Ofgem on 14 March 2022 (following an initial decision on 26 May 2021). The trial initially ran for up to two years, with provision for a one-year extension to allow for a BSC Modification to be raised. Emergent raised BSC Modification P455 on 31 May 2023, within the trial period. P455 was approved by Ofgem on 17 September 2024 and implemented on 24 September 2024, at which point the derogation was no longer needed as the on-site aggregation methodology became a permanent feature of the BSC.

2. Impact of the project and the Sandbox

Impact of the BSC Sandbox trial

On trial participants (residents and landlords)

The trial addressed a practical problem that had been affecting settlement accuracy at the trial sites. At the point the trial commenced, a number of customers at both the Gateshead and Nottingham sites were already receiving supply through a third-party supplier rather than through the microgrid supplier (which was the relevant councils in question). However, under the existing BSC arrangements, the metered volumes for these third-party-supplied customers were not being correctly deducted from the boundary point meter readings. This meant settlement data was inaccurate — the boundary point customers (the councils) were being settled for electricity volumes that were in fact being consumed by customers of another supplier.

The application of the on-site aggregation methodology corrected this situation. By submitting aggregated sub-meter data for the microgrid customers into settlement (in lieu of boundary point meter data), the settlement volumes were accurately allocated between suppliers for the first time. This benefited all parties: the councils were no longer over-settled, third-party suppliers' customers were correctly accounted for, and the overall integrity of settlement data for these sites was improved.

For landlords and housing companies, the trial provided confidence that Emergent's microgrid model was built on consumer choice rather than consumer lock-in. This was an important factor in securing partnerships, particularly with social housing providers, who needed assurance that their residents' rights would be protected.

On the system (balancing and settlement processes)

The trial demonstrated that the on-site aggregation methodology produces settlement data of equivalent accuracy to difference metering. As Ofgem noted in its P455 decision letter, the methodology was "tested and validated as producing the requisite quality of settlement data." Indeed, the trial corrected pre-existing settlement inaccuracies at the trial sites where third-party supplied volumes had not been properly accounted for. The trial did not create any adverse impacts on balancing or settlement processes.

On suppliers and other BSC party members

The trial placed no mandatory obligations on other BSC parties. Participation was entirely voluntary. The methodology was designed so that third-party suppliers wishing to supply customers on a private network using on-site aggregation would not need to enter into bespoke contractual arrangements with the boundary point supplier or its agents — significantly reducing the barriers to entry. Emergent worked with an HHDC partner on the delivery of the trial, contracted on a commercial basis.

On non-participating end-consumers (residents that opted out)

Residents who chose not to switch supplier were unaffected by the trial. Their supply arrangements continued as normal. The on-site aggregation methodology only changes the mechanism by which settlement data is collected and submitted — it does not alter the supply arrangements for any individual consumer. Those customers who were already being supplied by a third-party supplier at the trial sites benefited indirectly, as their volumes were now being correctly accounted for in settlement.

Impact of the Energy Regulation Sandbox on the project's design and execution

Impact of engagement with the Innovation Hub and Elexon

Engagement with Ofgem's Innovation Hub and Elexon was integral to the design and execution of the trial. The BSC Sandbox process — including Elexon's consultation, the BSC Panel's review, and Ofgem's assessment — helped Emergent refine its methodology and ensure it was operationally sound before going live.

Elexon's role as BSC administrator was particularly valuable. As this was the first ever BSC Sandbox derogation, both Emergent and Elexon were navigating a new process. The collaborative approach taken by Elexon — working with Emergent to develop the application, consulting with industry, and managing the BSC Panel recommendation — set a positive precedent for future Sandbox applicants.

What difference did receiving the BSC derogation make?

The BSC derogation was transformative for Emergent's business case and market credibility:

- **Business model viability:** Without the ability to offer residents a genuine right to switch, Emergent's microgrid model would have faced fundamental questions about consumer fairness — particularly in social housing contexts where residents may be in vulnerable situations. The Sandbox demonstrated that the model could operate with full consumer choice embedded.
- **Investor confidence:** The derogation — and the pathway it created towards permanent regulatory change — gave investors confidence that Emergent's model was not dependent on a regulatory loophole or temporary arrangement but was being actively supported by the regulator as a beneficial innovation.

- **Partnerships with housing companies:** Social housing providers in particular required assurance that residents' switching rights would be protected. The Sandbox award provided this assurance and was referenced in Emergent's engagement with Hackney Council and other housing partners.
- **Industry recognition:** This was the first ever regulatory Sandbox derogation to parts of the BSC, positioning Emergent as a regulatory innovator and helping build credibility with potential partners, funders and industry stakeholders.

3. Insights and lessons learned

Experience of running a live Sandbox trial

Overall experience

Emergent's overall experience of the BSC Sandbox trial was positive. The Sandbox provided a structured, low-risk environment to test a novel methodology in a live market setting, with the explicit backing of both Ofgem and Elexon. The process from application through to derogation award, trial, and subsequent BSC Modification was, while lengthy, logical and well-supported.

What worked well

- The clarity of the Sandbox process and the support provided by Ofgem's Innovation Hub team and Elexon.
- The fact that the BSC Sandbox was explicitly designed to allow a successful trial to lead to a permanent Modification — this "test and mainstream" pathway gave the trial a clear purpose and endpoint.
- The collaborative working relationship with Elexon throughout the trial period, including quarterly reporting.
- The willingness of the BSC Panel to designate Emergent as a Third Party Proposer for Modification P455, despite Emergent not being a BSC Party — recognising that the innovator best placed to propose the change should be empowered to do so.

What didn't work, or didn't go to plan

The proving test requirement

A requirement was included for a "proving test" within the project. In practice, this was extremely difficult to administer due to the size of the sites and the specific nature of the metering requirements. We had to meter every single feeder from the microgrid serving a third-party supply customer, collecting data that could be aggregated with data from opted-in customers to demonstrate that the boundary point meter data was correct.

At the Gateshead site, this meant metering approximately 60 customers spread across different floors of a high-rise block, all for the exact same half-hour period. The only practical options were either to fit new metering equipment for every one of those

customers — which completely defeated the purpose of the modification — or to temporarily disconnect electricity supply to all the properties so that we could demonstrate our installed meters for the opt-in customers matched the boundary point meter data. We had to take the latter course: a hugely expensive, laborious and highly invasive process for customers.

The data calculation we had proposed was, in fact, extremely simple. The proving test requirement was overly onerous relative to what was actually being tested. This is understandable given that the BSC Sandbox was a new process and there was a natural desire for rigour. But looking forward, we would encourage Ofgem and Elexon to ensure that trial requirements are proportionate to the complexity and risk of the innovation being tested. Simple proposals should be tested simply.

Incumbent opposition to the code modification

Emergent faced unwarranted objections from incumbent opposition during the P455 modification process as has been described in detail in a summary for policy makers. The experience demonstrated quite how difficult it is for new entrants to change industry rules when faced with well-resourced incumbents. The process highlights the need for safeguards to ensure that formal modification procedures are respected, and that objections are assessed on their technical merits rather than their commercial motivation.

The commercial risk to innovators

Emergent's business model rested entirely on this piece of regulation being changed. During the years the modification took to progress, we were essentially uninvestable — a very small company with thin capitalisation, carrying the risk that if the modification failed, there would be no business. A more established company might have moved faster but would likely not have had the same appetite to attempt it.

Our ability to use the Sandbox exemption to engage with customers and demonstrate how the solution could deliver value was central to our ability to survive during the modification period. This enabled us to progress projects that we closed shortly after the code modification passed — important early revenue that helped establish the business model in the market.

The opportunity to operate with a Sandbox exemption is an substantial risk for an innovator, and therefore it is important that companies taking on these risks are rewarded through the potential competitive market advantage based on our investments. Our original proposal was for a 10,000-customer trial limit, which Elexon were comfortable with; we ended up with 2,000 (though in practice we were nowhere near either figure). The principle matters: the greater the market incentive available to the innovator, the more likely they are to commit the investment needed to progress a trial.

Findings from the trial

Was the trial successful in its aims?

Yes. The trial was successful in all three of its core aims:

- **Settlement accuracy demonstrated:** The on-site aggregation methodology was shown to produce settlement data equivalent to that which would have been produced by difference metering, as confirmed by Ofgem in its P455 decision letter.
- **Simpler, less costly and more scalable:** The methodology removed the need for third-party suppliers to enter into bilateral contractual arrangements with the boundary point supplier and its agents, and removed the requirement for half-hourly settlement as a precondition for TPA — addressing the two principal barriers that had prevented any domestic customer on a private network from switching supplier since TPA rights were introduced in 2011.
- **Permanent regulatory change achieved:** The trial provided the evidence base for BSC Modification P455, which was approved by Ofgem on 17 September 2024 and implemented on 24 September 2024. Ofgem described this as "the first Sandbox trial which has gone through the entire controlled test and mainstreaming journey available via the BSC Electricity Sandbox, leading to permanent regulatory change."

This is a significant outcome — not just for Emergent's business, but for the estimated hundreds of thousands of domestic consumers connected to private networks across the UK who now have, for the first time, a practical mechanism to exercise their right to switch supplier.

Broader insights for policy and regulation

Insights relevant to policy or decision makers

1. Legal rights without practical mechanisms are insufficient. The right to TPA has existed since 2011, yet Ofgem's P455 decision noted that a major DNO had never encountered a domestic customer on a private network being supplied via a difference metering arrangement. The gap between legal entitlement and practical ability to exercise that entitlement had persisted for over a decade. This suggests a need for more proactive monitoring by Ofgem and DESNZ of whether consumer rights are being realised in practice.

2. The Sandbox "test and mainstream" pathway works. Emergent's experience demonstrates the full intended lifecycle of the BSC Sandbox: application, derogation, trial, evidence gathering, Modification proposal, industry assessment, and permanent code change. This validates the Sandbox as a mechanism for evidence-based regulatory reform and should give confidence to future innovators.

3. Industry codes can be barriers to innovation. The BSC rules were not designed with private networks or microgrids in mind. As the energy system increasingly incorporates distributed generation, storage and local supply arrangements, the industry

codes will need to continue adapting. The P455 experience suggests that innovator-led Modifications — where the entity closest to the problem is empowered to propose the solution — can be an effective complement to industry-led code reform.

4. Cross-code coordination remains a challenge. The P455 Workgroup engaged extensively with DNOs and DCUSA on the interaction between on-site aggregation and distribution charging. While it was concluded that P455 is independent of any DCUSA change, the question of how fixed DUoS charges should be allocated on sites with multiple suppliers remains unresolved and is now the subject of Emergent's second Sandbox (the 2023 DCUSA Sandbox) and the DCUSA DCMDG 'Private Networks' Subgroup. Better coordination between BSC and DCUSA governance processes would benefit future innovators navigating similar cross-code issues.

5. The energy transition will increasingly involve licence-exempt supply. As rooftop solar, heat pumps, EV charging and battery storage become more prevalent in residential settings — particularly in blocks of flats where shared infrastructure is necessary — the number of private networks and licence-exempt supply arrangements is likely to grow significantly. Policy makers and regulators should anticipate this and ensure that the regulatory framework supports rather than inhibits these arrangements, while maintaining appropriate consumer protections.

The licence exemption framework and local energy

Taking this modification through — in practice, an extremely small piece of metering-related regulation in the BSC — has been important in raising a much larger conversation about how local energy fits into the national industry.

There were various issues raised in the P455 workgroups that were left unresolved: what happens if microgrids scale up to very large volumes? What does this mean for flexibility and energy system value? There are both risks and opportunities in the expansion of local energy.

What bringing this to market has shown is that with a small tweak in regulation, you can open up a large new market opportunity in local clean energy that benefits both customers and the wider system. It has also shown that the licence exemption framework — now 25 years old — is utterly anachronistic and out of date for the challenges we face in the current electricity market.

While it is possible to deploy and scale microgrids underneath the existing framework, there is no doubt that the framework is due for a complete overhaul. This should not be seen as overly daunting: the licence exemption is a piece of secondary legislation, and an informed review can reveal that relatively small changes could again unlock large new market opportunities in local clean energy.

We therefore strongly urge Ofgem to work closely with DESNZ — given that responsibility for this legislation sits with DESNZ — so that these opportunities can be opened up. The approach is relatively straightforward: identify what small changes to the licence exemption framework could be enacted, assess the risks and opportunities each

would create, design trials and demonstrations to test them in practice, gather data, and establish regulatory frameworks that enable the opportunities while mitigating the risks.

Additional regulation or policy posing barriers

The BSC Sandbox trial addressed the settlement and switching barriers, but Emergent has identified further regulatory and policy areas that require attention:

- **Distribution charging (DUoS) on private networks with TPA:** This is the focus of Emergent's 2023 DCUSA Sandbox, which is trialling a methodology for ensuring DUoS charges are levied appropriately where there is competition in supply on a microgrid. The existing DCUSA framework does not adequately provide for sites with multiple suppliers.
- **License exemption framework** – this urgently requires reform, which will need to be delivered in coordination by DESNZ and Ofgem. Ideally it needs an overhaul. But even just well-targeted tweaks could unlock a huge amount of opportunity.

Next steps

Following the approval and implementation of BSC Modification P455 on 24 September 2024, the on-site aggregation methodology is now a permanent feature of the BSC, available to any private network operator wishing to facilitate Third Party Access for domestic and small business customers.

Emergent's immediate priorities include:

- **Scaling deployment** of the on-site aggregation methodology across our growing portfolio of microgrid sites.
- **Completing the DCUSA Sandbox trial** (2023 Sandbox, evaluation due May 2027), which addresses the related question of how DUoS charges are allocated on sites with TPA — a necessary complement to the BSC changes achieved through P455.
- **Supporting industry adoption of the P455 methodology** by helping Elexon, Ofgem and others to understand how it works in practice and what potential now exists for additional regulatory changes that could help the on-site aggregation process to work better in a more streamlined way, while also furthering open up the opportunity for local energy.

4. Anything else

Feedback and recommendations on the Energy Regulation Sandbox

Emergent was the first innovator to receive a BSC Sandbox derogation, and the first to complete the full "test and mainstream" journey from Sandbox trial to permanent code change. From this experience, Emergent offers the following observations and recommendations.

What worked well about the Sandbox

- The existence of the Sandbox itself — without it, Emergent would have had no mechanism to trial the on-site aggregation methodology and would likely have had to pursue a speculative BSC Modification without the evidence base to support it.
- The support from Ofgem's Innovation Hub team and from Elexon in navigating the process.
- The structured pathway from derogation to Modification, including the provision for a one-year extension to allow a Modification to be raised during the trial period.
- The BSC Panel's willingness to designate Emergent as a Third Party Proposer, enabling the innovator to drive the Modification process.

Recommendations for improvement

- **Proportionate trial requirements:** The proving test requirement was disproportionate to the simplicity of the data calculation being tested. Future trials should be designed so that the rigour of the testing is proportionate to the complexity and risk of the innovation. Simple proposals should be tested simply.
- **Commercial recognition for innovators:** Companies taking on the risk of regulatory innovation should be rewarded with meaningful market opportunity. The Sandbox exemption period is a critical window for innovators to build commercial traction. Larger trial limits and longer exemption periods would increase the incentive for innovators to invest.
- **Protection from incumbent resistance:** The modification process should include safeguards against last-minute interventions that circumvent the formal consultation procedures. The experience of incumbent opposition to P455 suggests that additional scrutiny may be needed to ensure that objections are evidence-based rather than commercially motivated.
- **Timelines:** The end-to-end process from Sandbox application to permanent code change took approximately four years. For a small, resource-constrained innovator, this creates significant business risk. Ofgem and Elexon should consider whether the process can be streamlined without compromising rigour.
- **Cross-code coordination:** Where an innovation spans multiple industry codes, the Sandbox process would benefit from more joined-up coordination between code administrators and Ofgem. Emergent has had to navigate two separate Sandbox processes with different timelines, requirements and governance.
- **Proactive barrier identification:** The Sandbox is currently reactive. Ofgem should consider using insights from Sandbox applications to proactively identify systemic barriers in the codes and initiate reform, rather than relying solely on individual innovators to drive change.