Making a positive difference for energy consumers

Network Innovation Competition Screening Submission Pro forma v.5

Notes on completion

Before completing this form, please refer to the relevant Network Innovation Competition (NIC) Governance Document.[1]

Please use default font (Verdana size 10) in your submission and retain 1.5 line spacing.

We will only accept the text visible in the text entry areas.

The text entry areas are predetermined and should not be changed.

The full-completed submission should not exceed 19 pages in total.

Ofgem will publish all the information contained within this Screening Submission.

Funding Licensee
Northern Powergrid
Project Partners including other Licensees
Delta-EE, TNEI
Project Title
Community DSO

[1] https://www.ofgem.gov.uk/publications-and-updates/version-30-network-innovation-competition-governance-documents All capitalised terms used in this document have the meaning given to them in the respective NIC Governance Document.

Project Summary
The **Community Distribution System Operator (Community DSO)** project will address a major future energy system challenge. How can Distribution Network Operators (DNO) support the roll out of **smart local energy systems (SLES)** across the lower voltage network in a way that is **equitable, scalable and affordable**? SLES has the potential to **unlock huge value** of **flexibility and efficiency** across the energy system and it's an important tool to enable the uptake of technologies that support **net zero energy**. However, SLES is complex, expensive to deploy and can cause networks issues in neighbouring areas. To respond to this challenge, the Community DSO project will develop and trial approaches to allow **communities and local stakeholders** to work together with their DNO to deploy SLES. This collaborative approach will meet the needs of the local community, the network and its assets. This will maximise value **socially, environmentally and economically** and build network **resilience**. By organising the network into **replicable** asset **"cell"** structures (e.g., an entire LV feeder), communities can take an active or passive participatory role in providing new DSO functions. The proposed **"manage, monitor and model"** approach ensures valuable outcomes **available to all** customers. This will support a **just transition** to a net zero providing routes for all within the cell to benefit. The DNO supports this directly by coordinating across groups of cells and ensuring optimisation of the wider network. Trials will be carried out in four local communities encompassing **rural and urban networks**. The project is a partnership between two expert energy systems consultancies, **Delta-EE and TNEI,** and **Northern Powergrid**, with support from **UK Power Networks**. We are engaging further with prospective partners **(community groups and technology providers).**

Estimated Start Date		**Estimated End Date**	
01/01/2023		01/04/2027	
Total Project Cost	Approx. £13.3M	**NIC Funding requested**	Approx. £12M
Technology Readiness Level (TRL) at start and end of project			Start: 4, End: 7/8

What is the Problem that the Project seeks to address?
Energy generation and demand management is becoming increasingly decentralised. One type of decentralisation is the formation of Smart Local Energy Systems (SLES). These could play a very important role in the future energy system, with many schemes and approaches already in development. This project will consider the potential for local communities to take responsibility for managing LV network flexibility within a SLES. But there are issues and barriers which could limit further SLES deployment: • Each SLES design performs differently, potentially uniquely, in economy, technical effectiveness, and in how it impacts the broader network. Connection approaches are not consistent. Designs and impact studies must be constantly repeated. This is inefficient and costly for customers and leads to sub-optimal systems. • Local management, individually and in combination, may lead to significant increased complexity and a sub-optimal system at a larger scale. This reduces network stability and reliability and raises network costs. • Communities can find it challenging to deliver local energy schemes due to their complexity and lack of standardisation. This may discourage take-up of low carbon technologies slowing net zero delivery and can result in missed opportunities. • First adopters in SLES often preferentially consume system and benefit resources by, for example, shifting fixed costs to others. This may unfairly reduce the ability of later adopters (who may be fuel poor or more vulnerable) to participate. The central hypothesis of this proposal is that DNOs should be more actively enabling and supporting customers to develop their own effective SLES solutions, with connected communities on the LV network taking part of the role of a local DSO. In doing this, DNOs should be technology agnostic but provide easy-to-use common frameworks and design approaches to ensure that any SLES, or combination of independent implementations, is economically efficient, effective, and manageable across the whole system, whilst providing a good solution for the DNO. This should also support a level playing-field allowing a fair net-zero transition for all customers. This approach responds to many strands of UK policy set out in the UK Net Zero Strategy, in particular the need for "flexible grid management", "account for the needs of local communities" and "incorporate low carbon and flexible technologies efficiently".

What Method(s) will be used and why? Ie, what is being demonstrated or developed? Please describe in terms of the NIC eligibility criteria. (page 1/3)
Community DSO will empower communities to take responsibility for managing flexibility on their own local low voltage (LV) networks. This concept will create local energy communities from groups of customers who share local network infrastructure. This community **will actively support the operation of their local distribution system by integrating low-carbon technologies, local market models, and network flexibility with existing assets.** The project will deliver standardised approaches for DNOs which will allow this to be transparent and highly scalable, enabling rollout of flexibility across the entire LV network. The project will scope, design, and build techniques and tools for decentralised management of smart, physically connected local energy systems, and then test them in field trials. These will consider a range of different networks archetypes, with a local LV cable forming the backbone of the local energy community. A **"Manage, Monitor & Model"** approach will provide benefits for all customers, including those who are unable to actively participate. The concept separates areas of a network into **hierarchical cells**, which split DSO operation into manageable chunks that reflect the network's infrastructure while supporting customer needs. An LV feeder (100s of customers) could be a single cell, with a group of LV feeder cells then interfacing with an HV cell at the HV/LV transformer. While management within a cell may be facilitated and supported by the DNO, some new DSO functions and obligations will be devolved to the local community and the systems employed within the network. The DNO will have options to influence this, for example, by imposing limits on what the community can do (e.g., a limit on how much power can be imported or exported over the secondary transformer). The DNO would also be responsible for coordinating multiple cells, ensuring there are no unintended consequences. Direct DNO involvement in operation – for example, the circumstances in which a DNO could override the decisions of the community DSO - will be examined within the project. A key feature is the direct integration of the technical constraints and engineering of the LV network into the operation of a local energy system. This builds on approaches taken in previous projects, which have involved either (i) more centralised decision making (including by a DNO), or (ii) put less emphasis on the engineering constraints of the networks. The cellular approach would instead empower third parties (particularly local communities) to reflect their needs and ambitions, with less centralised DNO decision-making, while still preventing unintended consequences for the wider system.

What Method(s) will be used and why? (page 2/3)

The project will comprise three key workstreams:

- WS1: Design and development - to design and simulate the proposed solutions.
- WS2: Field trials - to test the approach with real communities on NPg's network.
- WS3: Impacts and implementation - to understand the benefits of the solutions and identify pathways for integration into a DNO's business.

These workstreams will run iteratively over the period of four years with an agile approach, allowing learning from earlier trials (including learning on impacts and implementation) to inform later design, development and trial activity. From this, the project will deliver a clear how-to guide with characterised and standard cellular design suggestions for roll-out.
The activities to be completed under each workstream are described below:

WS1: Design and development activities will include:

- Developing an understanding of current and future local energy approaches and archetypes, based on engagement with communities and stakeholders (such as Community Energy England), and mapping these to DNO networks. This will define the needs that customers will have, the services that DNOs will provide, and the role, functions, and obligations of the community DSO.
- Development of architecture and solutions for delivery of hierarchical cellular community DSO functions, including software, data analysis, control solutions and hardware requirements for network monitoring and control. Novel predictive and decision-making algorithms that incorporate machine-learning and data science are likely to be very important for community DSO operation, as there is only partial visibility and controllability of LV networks. This work package will include simulation and trialling of the developed approaches within a virtual modelled environment.

These activities will build on research currently being undertaken by the project partners in the Community DSO NIA project.

WS2: Field trials activities will include:

- Identification and engagement with local communities to identify candidate areas for trials. For each trial (with four trial areas anticipated each made up of multiple cells) there will need to be a detailed design of the project, procurement processes to bring in necessary technology providers (including opportunity for innovation competitions with third parties), and installation and commissioning of equipment.

What Method(s) will be used and why? (3/3)
• Conducting field trials following an iterative approach (trial, review and modify), expected to last up to three years. This will include a combination of multi-cell hierarchical management on a network section (adjacent cells) and simulated cell management of cells across a broader network area. **WS3: Impacts and implementation** activities will include: • Following each stage of the trials, we will analyse the data gathered to understand impacts on both the DNO's network and the customers within the SLES. This will include a detailed assessment of cost of service, particularly for vulnerable customers. This will conclude with a cost benefit analysis at network and community level. • Identifying future pathways for regulatory evolution to enable business as usual operation. This will acknowledge the different role required by the DNO and define the commercial relationships with the community DSO. This work will also address issues such as asset management/maintenance and link with Ofgem's work on Access and DUoS.
Funding Commentary (page 1/2) *Licensee must provide a commentary on the accuracy of its funding estimate. If the Project has phases, the Licensee must identify the approximate cost of each phase. If the NIC is being used as match funding, please state the other sources of funding.*
This NIC funding application is for £12m, of a total £13.3m project. NIC funding is being requested to fund design, development, and testing of the Community DSO operational model. This will include: • WS1: Design and Development. Design of the proposed solution. £2.2M • WS2: Field Trials. Design and integration of proposed solution across a number of local energy systems. £9.2M • WS3: Impacts and Implementation. Understanding the benefits of the solutions and identify pathways for integration into a DNO's business. £1.9M These initial costs are based on an agile and phased development approach, estimated during project scoping and are a rough order of magnitude with an uncertainty of +/-30%. They are an initial estimate of effort required for the design, development, and analysis tasks based on the team's experience of working on other network and research projects. These costs have increased slightly from earlier estimates to account for the impact of the energy price cap increase, increasing supply chain costs, and the increasing rate of inflation.

Funding Commentary (page 2/2)

The costs associated with implementing the solutions in a field trial environment draw on Delta-EE's research into local energy systems and use several assumptions around approximate costs per a connected customer. In particular:

- Approx. £1,000 trial implementation costs per small, connected customer, assuming an average of 500 connected customers in each of 4 trial areas.
- Approx. £100,000 per large, connected customer (e.g., district heating scheme with flexible electricity asses such as Heat Pumps or Combined Heat and Power) assuming 1 large, connected customer in one or more of 4 trial areas.

These costs are illustrative and estimated from 2019 prices. The components of and participants within each of the trial areas will vary, and identification of the example cell structures to include within the trials will be refined through ongoing research.

Allowance within the budget has also been made for extensive community engagement activities to inform the SLES toolkit development, and engagement with trial areas, and for consumer engagement to assess the customer impacts and benefits.

The costs will be refined at the next stage once further details of partners and technical solutions is available and clearly scoped.

Which specific requirements does the Project fulfill?	
Mark YES in the appropriate box(es)	
A specific piece of new (ie unproven in GB) equipment (including control and/or communications systems and/or software)	
A specific novel arrangement or application of existing electricity transmission and/or distribution equipment (including control and communications systems software)	**X**
A specific novel operational practice directly related to the operation of the electricity transmission and/or distribution systems	**X**
A specific novel commercial arrangement	**X**

How does the Project accelerate the development of a low carbon energy sector and have the potential to deliver net financial benefits to existing and/or future customers in the relevant sector? (page 1/2)
Standardised community DSO models for delivering SLES approaches will help local communities to pursue their energy system ambitions more efficiently, cheaply and quickly, accelerating the deployment of low carbon assets. In combination with the hierarchical cell management approach, this could enable the greater uptake of low carbon technologies in a more efficient manner for networks and local communities, limiting network investment and maximising community value. If the approach is less coordinated without the input of DNOs, then it is likely to lead to a myriad of incompatible SLES solutions which are less effective for decarbonising local communities, and which significantly reduce the potential benefits for the distribution network and broader system. In particular, the Community DSO concept could provide a cost-effective means for implementing flexibility across the entire LV network, where the cost impact of decarbonisation of heat and transport could otherwise be very significant. For example, a 2019 report for the CCC by Vivid Economics and Imperial College estimated that the costs of upgrading LV circuits and secondary transformers could exceed £15bn by 2035. A reliable and scalable method for implementing flexibility on these networks therefore has the potential to create very significant savings for GB consumers by deferring these costs into

Accelerates the low carbon energy sector (page 2/2)

the future or possibly avoiding them permanently. A more specific estimate of the possible benefits is being carried out as part of the Community DSO NIA project and will be incorporated into the FSP.

These financial benefits will ultimately be reflected in reduced DUoS charges. These benefits would be socialised to an extent, although too much socialisation of these benefits could disincentivise the useful flexibility that the concept seeks to promote.

Other benefits that could arise from the project include:

- Reduced disruption associated with upgrading local LV networks.
- The provision of templates and demonstrations for how DNOs can support and empower local communities to deliver LV network flexibility in a time and cost-efficient manner, which works for both the community and the network.
- Helping communities manage their demand and supply at a local level, providing increased capacity for local low carbon generation within existing network constraints, including the use of cross vector coordination (for example using district heating as a storage mechanism for the electricity network)
- Providing a demonstration platform in the trials to allow innovative suppliers, aggregators, and technology providers to test low carbon solutions and management approaches in a local energy system environment.
- Enabling the broader delivery of a smarter, more flexible energy system, which could save the UK around £8bn per year (according to Imperial College analysis for CCC).
- Enabling local authorities to engage more efficiently in energy planning and management through working with communities and networks in a structured and replicable way, helping catalyse both Community DSO and DNO roles in terms of the broader benefits of local planning and economy management.

CO_2 savings will vary by network type and the low carbon assets it contains. However, as an enabling method, the project could unlock carbon savings from other solutions (e.g., energy sources, cross vector optimisation, aggregated DSR) which are essential for the UK to achieve its net-zero target and enables the electricity (and energy) system to be decarbonised. Reduced coordination at the community level could lead to slower and potentially lower deployment of low carbon assets, combined with higher network reinforcement costs and embedded carbon in network assets.

How will the Project deliver value for money for electricity customers?
Net financial benefits to existing and future customers will be derived from direct savings as part of a SLES. Key features of the benefits include: • 10 – 25% typical energy cost savings derived from local generation and management, according to 2020 research conducted by Delta-EE looking across a range of SLES projects and typologies (Delta-EE research based on existing schemes). This project would help SLES communities to save upwards of £50,000 per year period (approximately 5000 customers saving £100 or more per year each). • Recent electricity price increases mean that this figure will in future be higher (as much as 50%) based on 2022 retail tariffs. The optimisation of the local system and DER assets can mitigate the volatility of tariffs dependent on global energy costs. • Equitable benefits for all customers within a SLES, and from the development of the whole energy system, ensuring a just transition with no-one left out. • Unlock local development and associated economic benefits (e.g., housing, business creation) through reduced or removed network reinforcement needs, while maintaining the economic benefits of decentralised generation for customers in the community. The project additionally delivers value for money because: • Project activities will be carried out efficiently, with any further partners and subcontractors appointed through competitive procurement. • Partners will contribute in-kind funding through discounts (e.g., both Delta-EE and TNEI will carry out their work with a discount to their typical rates). • The project outputs will be in an open format (held by a body like ENA, Community Energy England, etc.) and usable by 1000s of SLES projects at minimal cost. • The technical implementation at a network level to deliver the coordinated hierarchical control will design and deliver new control arrangements and processes which can be implemented across networks with relatively little investment. By investing in the creation of knowledge, tools, and processes, and leveraging existing solutions and innovations from technical partners, the project has the potential for a significant scale up of value creation with relatively low costs. As a facilitator of a smart energy system, it will provide a low-cost option compared with more traditional approaches.

How will the Project generate knowledge that can be shared amongst all relevant Network Licensees?
The project will provide a proof of concept of a new commercial service for operating flexibility on local networks, with highly replicable outputs that can be reused for future deployments. The learning from this project can be used to inform future network operation strategies, and changes required to regulations to facilitate the approach. The enduring outputs from this project outputs will include: • A clear set of guidelines and standards/templates to support interoperability. Community DSO models for SLES will benefit communities and networks, and therefore the toolkit will be made available to all networks and communities via a wide range of stakeholders, including community organisations, local authorities, innovators, and network organisations. The project will explore where this information and potential toolkit should sit in terms of ownership and management, e.g., ENA, Community Energy England, etc. • Demonstration of pros and cons of operational approaches including hierarchical cell management. The project outputs will provide details on the specification for this, with initial implementation software with the hardware configuration developed, and open to use by other networks. These outputs will consider the learnings from the trials and experiments, with revisions and refinements. • The trial will provide a platform for innovative elements of the supply chain to test their approaches and equipment. This provides a significant base for development of new knowledge, supporting commercial development activities by both networks and innovators. • A dedicated project website / portal for information dissemination, engagement activities, and developing a 'home' for the outputs which can be transferred to a long-term owner. This could include, for example, a "how to" guide for the development of local energy systems by LV network-connected communities. UK Power Networks will also help to steer the project and disseminate learning more widely in their supporting role.

Answering Yes or No, does the Project conform to the default Intellectual Property Rights (IPR) arrangements set out in the NIC Governance Document? *If answer is NO, the Licensee must demonstrate how learning will be disseminated to other relevant Licensees and how value for money will be ensured. The Licensee must also outline the proposed alternative arrangements and justify why the arrangements are more suitable than the default IPR arrangements.*
Yes.

How does the project demonstrate it is innovative (ie not business as usual) and has an unproven business case, that the innovation risk warrants a limited Development or Demonstration Project to demonstrate its effectiveness?
This project's approach to balancing the control and requirements of the network with the development and empowerment of the community within the SLES is highly innovative and should enable both the DNO and the local communities within the SLES to benefit from a coordinated approach. Local energy systems are well researched, but existing work has not attempted to integrate the physical restrictions of a small-scale local network within a DSO-like operation of a SLES with a cellular approach to include all local customers across large areas. Instead, the existing approaches only look at one of the components: • Operate a SLES over a **wider geographic area** (e.g. Cornwall LEM) and consider the effects on the network as a secondary impact, which can reduce available benefits. • Take a more **centralised** approach to operating the network, typically led by the DNO (e.g., TRANSITION). This is complex to replicate and not community centric. Most importantly, the approach would involve a new role for the DNO, with responsibility for some aspects of DSO functionality devolved to local communities and third parties. This is fundamentally different to how DNOs currently operate, and would be too risky to achieve through gradual business as usual implementation without first researching and trialling it through an innovation project. There are challenging issues to deal with, such as responsibility and liability for ESQCR obligations, and the extent to which these can be managed by a Community DSO, which might limit technical and commercial models or introduce new requirements (e.g. for the community to have sufficient insurances). Nevertheless, the proposed method draws on existing tried and tested approaches and technologies which will come together to deliver solid foundations for the proposed solution. The underlying technologies and similar concepts have been explored through previous innovation projects including NIC and NIA funded projects (NPg's Microresilience projects, the TRANSITION, EFFS and FUSION group of projects by SSEN, WPD and SPEN, SSEN's Resilience as a Service project etc) as well as more general Local Energy System research and trial projects (such as the Cornwall Local Energy Market and Innovate UK projects).

How were Project Partners, external resources/funding identified, and what are their respective roles in the Project? Please evidence how Partners were identified and selected, including the process and rationale that has been followed. *The Licensee should provide details of any Project Partners who will be actively involved in the Project and are prepared to devote time, resources and/or funding to the Project. If the Licensee has not identified any specific Project Partners, it should provide details of the type of Project Partners it wishes to attract to the Project.*
The project concept originated in Autumn 2020, developed by Delta-EE and TNEI in response to an open call from ENA. The project will build on previous NPg innovation activities, including the NIA Microresilience, Distributed Solar & Storage Study, and Customer Led Distribution System projects. The concept has been developed further between NPg, Delta-EE and TNEI throughout 2021 and early 2022 through internal research and an ongoing Community DSO NIA project, which aims to identify key requirements for delivery of an effective trial project, including partnerships. • **NPg** will bring knowledge of their network, provide ESQCR oversight, and will host the trials to be conducted in Workstream 2. • **UK Power Networks** will also be supporting the project in a steering role. • **Delta-EE** will manage research and engagement, customer research, commercial analysis, market development and SLES and community DSO toolkit development. • **TNEI** will work with NPg to understand network impacts, lead the development of specifications of the SLES solutions, and undertake simulations for virtual trials. Further partners will be required before the project can commence in 2023, including: • Technology providers: to provide the infrastructure for operating the local system's cells, or the integration of several cells. • Community organisations: to inform the SLES delivery approaches and business models, alongside supporting field trials. • Suppliers/aggregators: who may support or lead the customer propositions. Partners will be identified and brought into the project after submission of the ISP, following competitive processes to ensure value for money for customers. We have engaged widely during ISP preparation, and there is significant interest from many prospective partners.

Would the Project require any derogations or exemptions to current regulatory arrangements? *If YES, please provide details of the required changes.*
We do not currently expect that any derogations or exemptions to current regulatory arrangements will be required. If necessary, we will endeavour to design the trials in a manner which does not require derogations or exemptions by using, for example, pseudo market signals. These allow incentives and pricing signals to be used as part of trial propositions in a layer which lies above the regulatory market and does not require changes to the customers' existing regulated supplies or services. The technical and commercial solutions will be developed to align with existing regulations – for example, responsibility, accountability, and liability for ESQCR obligations, and how this managed between the DNO and the Community DSO, will need to be considered. In the long-term, if the concept is proven during the trial and employed as business as usual, potential derogations may be required, for example if cell-specific DUoS pricing is used as a driver which may require LC14 derogation. There may also be a need to establish regulations to facilitate transactive energy models at the cell level. This will be considered in more detail as the project is developed further.

How will the Project activities impact customers? *The Licensee should outline any planned interaction with customers or customers' premises as part of the Project, and any other direct customer impact (eg amended charging arrangements, supply interruptions).*
We do not anticipate any disruption to customer supplies due to the **Community DSO** project except where communities have actively taken a decision to participate. Where possible the trial will be making use of existing SLES opportunities and customers with existing relevant assets. In that case, impacts are minimised or indeed have already occurred. There is a possibility that trials may require recruitment of individual customers within a participating community's local system. However, trials would be planned in a way that **minimises any impacts on individual customers**. There will be an opportunity to **participate actively and passively**, allowing those historically excluded from innovation trials, perhaps due to social or economic challenges, to take advantage of this opportunity. It is a key aim of this Community DSO project that the toolkit and business models developed can be part of the solution to ensure that communities and places affected by any disruption caused by the transition to net zero energy system have **equitable** access to innovation and market benefits and are **not 'left behind'**. A customer trial recruitment strategy will be developed to recruit appropriate participants and will build on learning from prior innovation projects. Customers will be identified via existing stakeholder databases or through engagement via a professional market research agency. Most interactions are anticipated to be with either customer and stakeholder groups, community organisations, and/or third parties/aggregators/suppliers. Where customers install new equipment as part of this trial (such as a smart heating control system, or smart battery storage), these will be deployed on a commercial basis through one of the project participants e.g., energy supplier. More detail on the interaction with end customers will be considered as we engage more widely within the NPg region as part of the NIA Community DSO project. We are engaged with active community organisations such as **VONNE** and **Community Energy England** consulting on best community engagement methodologies as part of the NIA work, which will inform the approach taken for this project.

Are there any further details the Licensee considers would support its submission?
This proposal is centred around the adoption of a Community DSO model for delivering SLES and has described how this would work and the potential benefits of this approach specifically. We provide here a description of the case for SLES in general, and the potential benefits they can bring to customers. SLES involving energy communities are evolving rapidly in response to both EU and national policy (for example the UK Energy White Paper) which intends to engage consumers with the energy transition. This is based on the belief that energy communities can achieve three key goals: 1. Engaging consumers with low carbon generation options 2. Providing and accessing additional sources of flexibility throughout the system 3. Accessing new sources of funding and generating value for local communities The net-zero energy transition requires the engagement of a broader range of stakeholders including consumers in the downstream system. SLES provides an important route to delivering this. This project aligns with the DSO transition demonstrating how communities and consumers can play a larger role in the network management and operation. Research by CE Delft (2016) identified that 'energy citizen' (consumer) electricity production could account for 19% of total European electricity supply by 2030 (and 45% by 2050), much of this delivered by citizen energy communities, or SLES. Cost savings are achieved by aligning local generation and resources with local demand in the community, which can minimise costs associated with use of the wider system. In addition, there are opportunities to gain revenue by using flexibility within the SLES to provide services to the DNO and ESO. There are further operational savings through enhanced network utilisation and reduction in losses. For end-use customers, these latter benefits can be up to 10% of cost savings. Energy cost savings depend on the type of SLES, but consumer bills can be reduced by up to 25% where systems achieve a good level of local balancing, based on 2020 pricing. Current values are expected to be significantly higher. This has been demonstrated in existing schemes such as the Brixton Community project (EDF and UK Power Networks) looking at peer to peer trading of solar PV, and the Cornwall Local Energy Market trial (Centrica and WPD). We are also aware of, and in discussions about, UKPN's 2022 Communiflex NIC bid.

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