**British Hydropower Association Response to RIIO-3 Statutory Consultation on Proposed Licence Modifications**

The BHA represents the UK hydropower sector across a wide range of scales, from long-established large infrastructure to community-owned and locally operated schemes. Our members are increasingly engaged not only in generation, but in questions of system integration, local value, flexibility, and resilience as the electricity system transitions to one dominated by renewables.

While we recognise that this consultation is primarily technical in nature, we welcome the opportunity to comment on several aspects that are relevant to the effective delivery of net zero and to the evolution of a more coordinated, whole-system approach.

# Whole-system coordination and innovation governance

We welcome the proposed inclusion of the National Energy System Operator (NESO) as an Interested Party in network companies’ Innovation Strategies. This is a positive step towards aligning innovation activity with a single, whole-system plan.

However, from a delivery perspective, we note a persistent structural gap between:

* national system planning and network regulation on the one hand, and
* local assets, local flexibility, and community-scale infrastructure on the other.

Hydropower, particularly run-of-river and small-scale schemes, already operates as part of this local system layer. These assets provide predictable, low-carbon generation close to demand, often embedded within rural or constrained parts of the network. Yet their system value is frequently under-recognised because there is no formal operational or governance layer that sits between individual assets and the national system.

We would therefore encourage Ofgem to consider how Innovation Strategies, and the licence frameworks that support them, can explicitly support the development of this “missing middle”: the local coordination, data, and operational layer that enables local assets to contribute effectively to whole-system outcomes.

# The Smart Grid Architecture Model

In this context, BHA would also encourage Ofgem to promote the use of a common reference architecture, such as the Smart Grid Architecture Model (SGAM), when developing and assessing network innovation strategies. As energy systems become increasingly distributed and digital, a shared architectural language is essential to ensure that stakeholders can consistently visualise what capabilities exist, where they sit on the network, and which layers are under-developed or missing altogether. SGAM does not prescribe technologies, but provides a structured way to distinguish between physical assets, data and information models, system functions, and business or regulatory roles. Without such a reference framework, there is a risk that innovation activity continues to focus on components in isolation, rather than addressing the information and functional layers required for effective system coordination. BHA has attached illustrative appendices showing how SGAM can be used to highlight current gaps — particularly at local and community scale — and to support clearer dialogue between network companies, system operators, innovators, and regulators.

# Unlocking local value and flexibility

A recurring challenge for hydropower developers and operators is that local system value, including flexibility, constraint management, and resilience, is difficult to evidence or monetise under current arrangements.

The consultation rightly strengthens expectations around reporting of consumer and community benefit. However, benefit realisation depends not only on reporting, but on whether the system architecture allows local value to be identified, aggregated, and acted upon.

Without a defined local system layer:

* local flexibility remains fragmented,
* innovation projects struggle to transition into business-as-usual delivery, and
* network investment continues to default towards reinforcement rather than optimisation.

BHA therefore sees a strong alignment between the direction of travel implied by this consultation and the need to accelerate the development of Smart Local Energy Systems (SLES) and other place-based coordination mechanisms that can sit between networks and communities.

# Investment discipline and non-network alternatives

We note the proposed amendments related to financial resilience and gearing thresholds. As network investment becomes more constrained, the importance of non-network solutions will increase. Local generation and flexibility assets, including hydropower, can play a meaningful role in reducing system costs and deferring reinforcement, but only if the regulatory framework supports their integration at a system level.

This again points to the need for a recognised intermediate layer capable of:

* coordinating local assets,
* interfacing with networks and system operators, and
* translating local performance into system-level value.

# Concluding remarks

In summary, BHA broadly supports the intent of the proposed licence modifications, particularly where they strengthen whole-system coordination and accountability. However, we would encourage Ofgem to view these changes as part of a wider transition that now requires explicit attention to the local system layer.

Without filling this “missing middle”, there is a risk that:

* innovation remains siloed,
* local value remains unrealised, and
* the full potential of distributed renewable assets is not captured for consumers or the system as a whole.

We would welcome further engagement with Ofgem on how hydropower and other local renewable assets can be better integrated into emerging local system architectures in a way that supports delivery, resilience, and value for money.

# Appendix - The Smart Grid Architecture Model (SGAM)

Diagram of a diagram of a diagram

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## Purpose of SGAM

The Smart Grid Architecture Model (SGAM) is a reference framework developed within IEC and European smart grid standardisation to support the systematic description of smart grid use cases, architectures, and interoperability requirements.

SGAM does not prescribe technologies or solutions. Its purpose is to provide a common architectural language that allows stakeholders to:

* describe where a use case sits in the power system
* understand which functions, data models, protocols, and components are required
* assess interoperability and standardisation gaps
* compare architectures consistently across projects and organisations

At its core, SGAM answers a simple but critical question: *If a given smart grid capability is to work in practice, what needs to align — and where?*

## The SGAM cube: three dimensions

SGAM is represented as a three-dimensional cube, combining system scope, control hierarchy, and interoperability layers. Each dimension answers a different architectural question.

### Domains (system scope)

The Domain axis describes where in the electrical energy conversion chain a function or use case applies. In the canonical SGAM diagram, the domains are shown along the front horizontal axis:

* Generation
* Transmission
* Distribution
* Distributed Energy Resources (DER)
* Customer Premises

These domains represent physical and operational parts of the electricity system. A use case may be confined to a single domain or span multiple domains (for example, Distribution ↔ DER ↔ Customer Premises).

SGAM makes cross-domain interactions explicit, which is essential for understanding modern smart grid use cases that span network boundaries.

### Zones (management and control hierarchy)

The Zone axis describes levels of control and management, shown vertically in the diagram:

1. **Process:** Physical energy conversion processes (e.g. electrical flow, mechanical conversion).
2. **Field:** Sensors, actuators, and primary equipment interfacing directly with the process.
3. **Station:** Aggregation and local automation, typically at substations or equivalent facilities.
4. **Operation:** System operation functions such as network control, monitoring, and supervision.
5. **Enterprise:** Business processes including planning, asset management, and organisational control.
6. **Market:** Market participation, trading, settlement, and regulatory interaction.

The Zones dimension distinguishes physical control, system operation, and business/market activities, which are often conflated in informal discussions.

### Interoperability layers (what kind of capability)

The Interoperability Layers form the third dimension of SGAM and are typically drawn as stacked horizontal planes cutting through the cube. They describe what type of capability or artefact is involved, from physical assets to business intent.

Component Layer

This layer contains physical components:

* power system equipment
* sensors and actuators
* protection devices
* IT hardware

These components are mapped to specific domains and zones (e.g. field devices in Distribution, station equipment at substations).

Communication Layer

This layer describes how information is exchanged between components:

* communication protocols
* network technologies
* transport mechanisms

The focus here is on interoperable data exchange, not on the meaning of the data.

Information Layer

The Information Layer represents shared meaning. In the SGAM diagram this is explicitly annotated as: “Data Model”

This layer includes:

* canonical data models
* information objects
* semantics and ontologies

Its purpose is to ensure that exchanged data is interpreted consistently by different systems and organisations. Data can exist without interoperability; information requires common semantics.

Function Layer

The Function Layer represents logical functions and services that realise a use case. In the diagram this layer includes:

* “Outline of Use Case”
* “Functions”

This reflects SGAM’s methodology:

1. Start from a use case
2. Derive required functions
3. Map those functions to information, communication, and components

Functions are defined independently of specific actors or implementations.

Business Layer

The Business Layer represents business objectives, policies, and regulatory frameworks, as indicated in the diagram by annotations such as:

* business objectives
* political and regulatory context

This layer captures:

* market rules
* roles and responsibilities
* organisational processes
* regulatory constraints

It ensures that technical architectures are aligned with institutional reality.

## Why SGAM is relevant

As energy systems become more distributed, digital, and cross-sectoral, the number of interactions between domains, organisations, and technologies increases rapidly. SGAM provides a stable reference structure that allows these interactions to be described, compared, and reasoned about consistently.

By separating components, communication, information, functions, and business context, SGAM helps ensure that smart grid solutions are coherent, interoperable, and scalable.

SGAM does not tell us what to build — it helps us understand what must align for any smart grid capability to work.

## How the Information and Function layers are underdeveloped

The SGAM framework helps explain not just where activity is happening, but where it is not. It is important to clarify **how information and function layers should be organised in a well-functioning smart energy system**, and where today’s gaps lie.

### The information layer (where the Community Energy Management System needs to sit)

**What it is**

It is a **network of nodes**, each operating at a different physical and social scale:

* The Information layer is where **raw data is turned into system intelligence**
* It sits **between devices and decision-making**
* This is not the control layer, it is about **representation and aggregation**

**What it does**

* Aggregates data from many assets and households
* Adds **context** (location, time, network topology, constraints)
* Creates **shared, trusted views of system state**
* Manages permissions, governance and data boundaries

**Why it matters**

* Decisions are only as good as the information they are based on
* Without this layer:
  + data remains fragmented
  + planners and operators see partial pictures
  + households are acted on without visibility or protection

|  |  |  |
| --- | --- | --- |
| Node | Domain | Zone |
| Household / HEMS | Customer Premises | Field |
| **Feeder (CEMS)** | DER | Station |
| Secondary substation | Distribution | Station |
| Primary substation | Distribution | Operation |
| Regional / National | Transmission | Market |

Diagram of a diagram of a structure

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Today, data exists at most of these levels, but persistent, governed aggregation at the community / feeder level is largely missing. This is the critical gap that prevents data becoming system intelligence.

### The Function layer: where intelligence becomes coordinated action and where the SLES sits

**What it is**

* The Function layer is where system intelligence is **coordinated and optimisation happen**
* It uses system intelligence to decide **what should happen next**
* It operates at multiple scales: local, distribution, national

**What it does**

* Resolves conflicts between competing objectives
* Coordinates assets to manage constraints
* Optimises outcomes (cost, carbon, comfort, security)
* Translates intelligence into **operational action**

**Why it matters**: Without this layer:

* flexibility is uncoordinated across the layer
* optimisation happens at the wrong scale
* risks are pushed onto consumers and networks

At present, much of the Function layer exists at **regional and national scale**, including:

* DSO flexibility procurement platforms
* National balancing and flexibility mechanisms
* Market-based price signals and optimisation tools

These functions are powerful, but they largely assume that **local system intelligence exists below them**. What is missing is a **dedicated local operating layer** that can:

* interpret feeder-level intelligence,
* resolve local constraints,
* sequence actions across assets,
* and reconcile local and national objectives.

|  |  |  |
| --- | --- | --- |
| Function layer | Domain | Zone |
| **SLES** | Distribution / DER / Customer | Field → Station → Operation |
| DSO flex platform | Distribution | Operation → Enterprise → Market |
| Tx flex platform | Transmission | Market → Enterprise |

**Diagram of a diagram of a grid with blue circles and lines

AI-generated content may be incorrect.**

The missing middle of the energy system is therefore not a single technology gap, but the **absence of coherent Information nodes (CEMS) paired with a local Function layer (SLES)**.