



KUDO



Low Carbon
Contracts
Company

KUDO SOFTWARE

Your software **partner** for renewable energy operations

WWW.KUDOSOFTWARE.COM

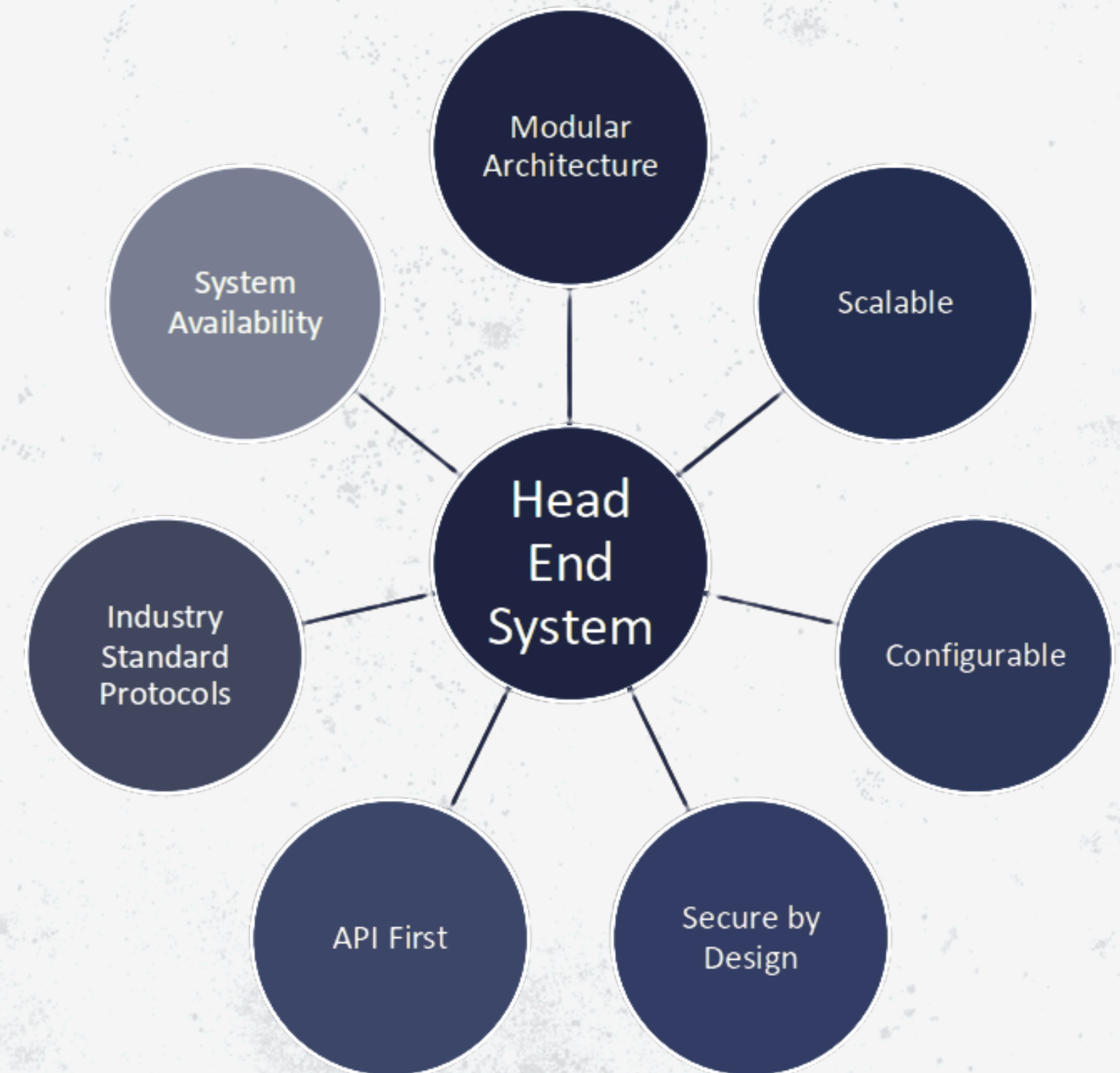
What is the LCCC Head End System?

System to collect, aggregate, reconcile and standardise metered, measured and related beneficiary data;

Best-in-class configurability using Smart Contracts, meaning future and updated schemes are supported;

Distributed Ledger to support Certifications, Metering and Sustainability compliance;

Modular, component driven architecture that can integrate new requirements and functions quickly and at low cost.



The HES is an automated data collection and aggregation system that centralises and streamlines data collection, improving reporting accuracy in line with scheme requirements and compliance.



Data Collection

The HES can automatically collect raw data from meters/SCADA/DAHS and able to ingest manual submissions via the Portal



Data Processing

A 'Smart Contract' defines which data and at what frequency should be collected for aggregation and to demonstrate compliance. Data that does not meet these parameters is rejected.



Data Aggregation

Raw data is aggregated and formatted based on each project and scheme. Aggregated data is available for reporting and assurance.



Data Sharing

The HES has multiple API endpoints for data pulling to external systems. All data is available for export via the portal.

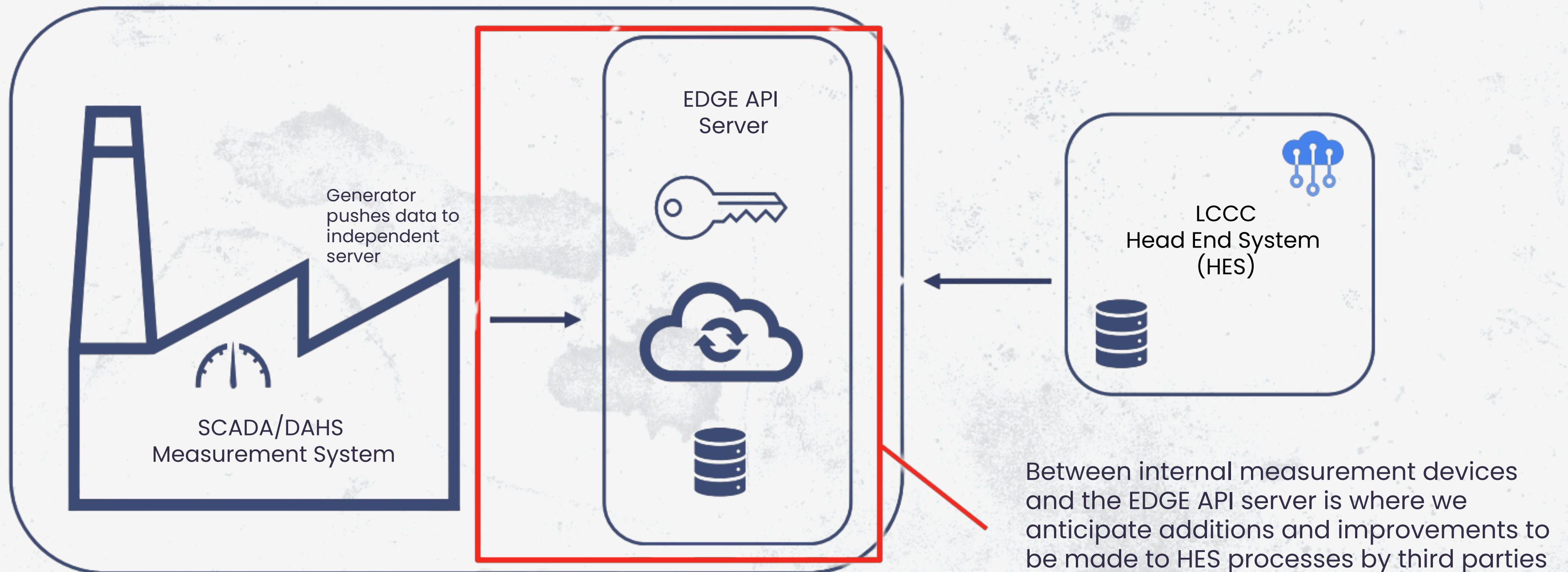
Evolution of HES Integration

Currently, LCCC and the HES integrate on a bespoke, project-by-project basis with individual generators

Leveraging established data-platform solutions offered by system equipment and service providers could enable a generic, repeatable integration model, allowing new projects to connect to the HES using a consistent and reusable architecture rather than bespoke implementations.

There is potential for greater efficiency and scalability by working with system equipment and service providers to act as data aggregators for our counterparties and simplify how we connect with projects

Access to data via Edge API



Edge API Details

The Edge API is currently the only integration mechanism for exposing metered and operational data to the HES

- The Edge API is a REST-based interface defined using the OpenAPI Specification (OAS) 3.1 standard.
- API endpoints are defined per individual data point and must be explicitly referenced
- Data providers may structure endpoints flexibly, provided all endpoints comply with the Edge API specification.

Authentication & Security

- OAuth 2.0 Client Credentials flow is required.
- Access tokens must be JWTs issued by a provider-managed Identity and Access Management (IAM) service.

Error Handling & Resilience

- HTTP 2xx responses indicate successful data retrieval.
- HTTP 4xx and 5xx responses trigger automated retry logic within HES, with defined exceptions (e.g. 401, 403).
- Retry behaviour respects Retry-After headers where provided.

Data Format

- Successful responses must conform to the published Edge API schema.
- All timestamps must be provided in ISO 8601 format and aligned to UTC.

Where KUDO comes in

KUDO bridges the gap between site data and HES requirements by simplifying how generators expose clean, structured, and compliant data via the Edge API. This layer introduces complexity between SCADA and DAHS systems and the HES interface, requiring data to be standardised, validated, continuously monitored, and made audit-ready before it is delivered.

How KUDO supports this layer

- Automates data collection and standardisation by pulling SCADA and metering data into a consistent, scheme-ready format
- Ensures Edge API readiness by structuring and validating data to meet HES schema, timestamp, and formatting requirements
- Delivers data directly and securely through reliable API-based delivery aligned with LCCC expectations
- Provides monitoring and alerting by flagging failures, gaps, or rejected data before they impact settlement
- Creates a single, trusted data pipeline that removes reliance on manual processes, spreadsheets, and bespoke scripts

The outcome

- Reduced settlement and compliance risk
- Audit-ready, traceable data aligned to scheme requirements
- Faster, repeatable integration with HES as new schemes are introduced

Where KUDO comes in



Portfolio

Map

Alarm Management

Active Data Health

Site Group

Site

Windy Hill

Site Summary

Site Details

Access and Weather

Inductions

Assets

Work Orders

Alarm Management Configuration

 Notifications

Joe Bloggs

2026-02-22

Current Time: 14:35 UTC+00:00

Data from 2026-02-21: 14:00 to 2026-02-22: 14:30

Active Data Health

2 Unhealthy

2 Healthy

● unhealthy

Gusty Glade

Green Energy Renewables

No Connection

Connected

● GEMS-API

● OPC-POP

● CSV-METER

Last Refresh

Next Refresh

Data Import By Stream

all

data gaps

no data

no connection

● GEMS-API

● OPC-POP

● CSV-METER

● OPC-POP

● SCADA_PR

● CSV-METER

● OPC-KEN

+1 More

Last Refresh

Next Refresh

Data Import By Stream

all

data gaps

no data

no connection

● OPC-POP

● SCADA_PR

● CSV-METER

● OPC-KEN

● GEMS-API

Last Refresh

Next Refresh

Data Import By Stream

all

data gaps

no data

no connection

● SCADA_PR

● CSV-METER

● OPC-KEN

● GEMS-API

14:00 90%

14:30 86%

15:00 89%

15:30 100%

16:00 77%

16:30 75%

17:00 95%

17:30 43%

18:00 81%

18:30 96%

19:00 97%

19:30 0%

20:00 12%

20:30 1%

21:00 3%

21:30 1%

22:00 7%

22:30 54%

23:00 99%

23:30 76%

00:00 67%

00:30 87%

01:00 88%

01:30 74%

02:00 45%

02:30 60%

03:00 21%

03:30 22%

04:00 --

04:30 11%

05:00 47%

05:30 --

06:00 --

06:30 --

07:00 --

07:30 --

08:00 --

08:30 --

09:00 --

09:30 --

10:00 75%

10:30 56%

11:00 21%

11:30 30%

12:00 33%

12:30 49%

13:00 25%

13:30 90%

14:00 --

14:30 --

LCHA Project Requirements

Data must be digitally collected, time-stamped, traceable to measurement points, and retained for the LCHA term plus post-term retention period.

Metering systems must meet defined accuracy and uncertainty limits, including:

- Hydrogen mass flow uncertainty $\leq \pm 1.0\%$
- Hydrogen energy flow uncertainty $\leq \pm 1.1\%$
- Hydrogen composition analysis uncertainty $\leq \pm 0.1\%$
- Electricity measurement uncertainty within $\pm 0.5\%$ to $\pm 2.5\%$ (depending on configuration)
- Water and oxygen measurement uncertainty $\leq \pm 3\%$

Measurement data must meet minimum temporal granularity:

- Hydrogen, feedstock gas, oxygen: $\leq$ 1-minute intervals
- Electricity: $\leq$ 30-minute intervals
- Implement cyber-security controls compliant with the LCHA Cyber Security Standards, specifically Cyber Essentials Plus or an equivalent scheme approved by the LCHA Counterparty.
- Support remediation, audit escalation, and access requirements in the event of a Measurement Data Integrity or Security breach under the LCHA.

Hybrid Metering Project Requirements

Data platforms that ingest, store, process, or transmit SCADA-sourced HM data to the Edge API must be capable of meeting the following technical requirements:

- Preserve measurement accuracy characteristics of source data, including scaling and resolution derived from CT/VT inputs calibrated to **IEC 61869-equivalent standards**.
- Maintain end-to-end data lineage from platform data points to originating measurement devices, including persistent identifiers and source mappings.
- Preserve SCADA tag semantics and naming, including alignment with applicable **IEC 61400-25** information models where used.
- Enforce controlled configuration and tag-logic change management, with version control, approval records, and immutable audit logs.
- Preserve original timestamps applied at point of data capture
- Ensure time synchronisation across the platform using **NTP-aligned system clocks**.
- Support secure data handling and transmission controls consistent with **IEC 62351** principles for confidentiality, integrity, and access control.
- Enable export of configuration, metadata, logs, and records necessary to support audit, assurance, and compliance verification.

Future Scheme Integrations

LCHA and Hybrid Metering projects are those currently integrating to the HES – more schemes are to be integrated into the HES going forwards, and these will have their own requirements for data handling and aggregation based on the schemes

Scheme	Integration specifics
Biomass	Support auditable data provision for variables used directly in RQM calculation, Fuelling Criteria compliance, Minimum and Threshold Aggregate Metered Output (MAMO/TAMO), and settlement formulas, including half-hourly Settlement Unit alignment and monthly RQM calculation periods
GGR	Systems must provide immutable data lineage, configuration versioning, and auditable processing consistent with ISO 14064 and certification-scheme requirements (ISO 17029 / ISO 17065),



KUDO



**Low Carbon
Contracts
Company**

Scheme	Integration specifics
Capacity Market	Support half-hourly metered data ingestion and submission for Capacity Market Units (CMUs) in accordance with EMRS G1 metering requirements and WP195 metered-data interfaces, including support for BMU, HHDA, DC, self-submission, and apportioned metering pathways. Systems must preserve timestamp accuracy at Settlement Unit level, support metering configuration management, change control, and audit evidence.
ICC/ ICCW	Support ingestion and reconciliation of continuous CO ₂ mass-flow data at defined capture and network entry points. Systems must provide immutable data lineage, configuration versioning, and auditable processing, and fuel configuration data sufficient to evidence eligible captured volumes, interface with licensed Transport & Storage operators, and meet long-term audit and liability requirements under ISO 14064-aligned verification frameworks.

Scheme	Integration specifics
DPA	Support ingestion and aggregation of metered operational data for electricity generation, CO ₂ capture availability, capture rates, and net dependable capacity, aligned to defined settlement and availability assessment periods. Systems must provide immutable data lineage, and be able to evidence availability payments, performance adjustments, and reconciliation of generation and Transport & Storage data under contract terms, consistent with ISO 14064-aligned requirements.
SAF	Manage evolving eligibility rules, feedstock classification changes, and methodology updates as data is transferred from project systems into HES, maintaining historical reproducibility of reported outcomes and sufficient transparency to support third-party assurance, scheme audits, and potential revenue reconciliation as UK SAF support frameworks mature.

Contact us

Location

KUDO, Ochil House, Stirling, Scotland, FK7 7XE

Email Address

hello@kudosoftware.com

Website

www.kudosoftware.com