ECR Digitalisation Design Recommendation

Open Networks | WS2 P1
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DOCUMENT CONTROL

Authorities

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1.0	20/01/2022	Open Networks Steering Group	
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Change history

Version	Change reference	Description
1.1	1	Update December 2022 section added

Distribution

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Introduction

About ENA

Energy Networks Association (ENA) represents the owners and operators of licenses for the transmission and/or distribution of energy in the UK and Ireland. Our members control and maintain the critical national infrastructure that delivers these vital services into customers' homes and businesses.

ENA's overriding goals are to promote UK and Ireland energy networks ensuring our networks are the safest, most reliable, most efficient and sustainable in the world. We influence decision-makers on issues that are important to our members. These include:

- Regulation and the wider representation in UK, Ireland and the rest of Europe
- Cost-efficient engineering services and related businesses for the benefit of members
- Safety, health and environment across the gas and electricity industries
- The development and deployment of smart technology
- Innovation strategy, reporting and collaboration in GB

As the voice of the energy networks sector, ENA acts as a strategic focus and channel of communication for the industry. We promote interests and good standing of the industry and provide a forum of discussion among company members.

About Open Networks

Britain's energy landscape is changing, and new smart technologies are changing the way we interact with the energy system. Our Open Networks programme is transforming the way our energy networks operate. New smart technologies are challenging the traditional way we generate, consume and manage electricity, and the energy networks are making sure that these changes benefit everyone.

ENA's Open Networks programme is key to enabling the delivery of Net Zero by:

- opening local flexibility markets to demand response, renewable energy and new low-carbon technology and removing barriers to participation
- providing opportunities for these flexible resources to connect to our networks faster
- opening data to allow these flexible resources to identify the best locations to invest
- delivering efficiencies between the network companies to plan and operate secure efficient networks

We're helping transition to a smart, flexible system that connects large-scale energy generation right down to the solar panels and electric vehicles installed in homes, businesses and communities right across the country. This is often referred to as the smart grid.

The Open Networks programme has brought together the nine electricity grid operators in the UK and Ireland to work together to standardise customer experiences and align processes to make connecting to the networks as easy as possible and bring record amounts of renewable distributed energy resources, like wind and solar panels, to the local electricity grid.

The pace of change Open Networks is delivering is unprecedented in the industry, and to make sure the transformation of the networks becomes a reality, we have created six workstreams under Open Networks to progress the delivery of the smart grid.

2021 Open Networks programme Workstreams

- WS1A: Flexibility Services
- WS1B: Whole Electricity System Planning and T/D Data Exchange
- WS2: Customer Information Provision and Connections
- WS3: DSO Transition
- WS4: Whole Energy Systems
- WS5: Communications and Stakeholder Engagement

Our members and associates

Membership of Energy Networks Association is open to all owners and operators of energy networks in the UK.

- Companies which operate smaller networks or are licence holders in the islands around the UK and Ireland can be associates of ENA too. This gives them access to the expertise and knowledge available through ENA.
- Companies and organisations with an interest in the UK transmission and distribution market are now able to directly benefit from the work of ENA through associate status.

ENA members

BUUK infrastructure
Cadent Your Gas Network
electricity north west Bringing energy to your door
ESB NETWORKS
nationalgrid
nationalgridESO
Northern Gas Networks
Northern Ireland Electricity Networks
NORTHERN POWERGRID
Scottish & Southern Electricity Networks
SGN Your gas. Our network.
SP ENERGY NETWORKS
UK Power Networks Delivering your electricity
WALES&WEST UTILITIES

ENA associates

- Chubu
- EEA
- Guernsey Electricity Ltd
- Heathrow Airport
- Jersey Electricity
- Manx Electricity Authority
- Network Rail
- TEPCO

Executive Summary

The Embedded Capacity Register (ECR) has become an essential dataset within the UK energy industry, it holds key information about generating resources connected or to be connected onto the UK distribution system. However, the current format used to disseminate ECR information is not future proof and requires modernisation.

The strategy proposed in this document is concerned with transitioning the ECR from an Excel based report to a machine-readable dataset transmitted via a REST API. The successful delivery of this project will ultimately support the UK energy industry achieving the Net Zero target.

Introduction to ECR

The Embedded Capacity Register (ECR), previously known as the System Wide Resource Register, is a standardised register of all sites larger than 1MW with Distributed Energy Resources (DERs) that are connected to or have an agreement to connect to their networks and influence the operation of the GB power system [1]. The ECR is published by every licenced DNO and IDNO on a monthly basis, this publication became a licence condition requirement by DCUSA code modification proposal DCP350 [1]. Within the DCUSA document, processes, procedures and Party obligations related to the ECR can be found under Clause 35C. 'Provision Of An Embedded Capacity Register' of Section 2A and in SCHEDULE 31 'Embedded Capacity Register' [2].

Existing format

The ECR is currently published as an Excel workbook and includes the following worksheets:

- Contents
- Definitions Part 1
- Register Part 1
- Definitions Part 2 (DSR)
- Register Part 2 (DSR)

The resource/generator dataset resides in the 'Register Part 1' worksheet and can vary in size depending on each DNO (from 450 to 1900 records). As mentioned in the section above, the register has a standardised format where the number and order of fields/columns is similar from one publication/DNO to the next. Any changes to the fields/columns or changes to the order in which they are presented has to be agreed by the ECR workgroup (WS2 P1).

Why digitalise the ECR

The existing ECR format (Excel spreadsheet) is mainly aimed at manual consumption directly in Excel, it has served this purpose perfectly well so far. Although the existing format can be ingested and consumed programmatically, it isn't optimal. Furthermore, ingesting ECR data from Excel sheets isn't sustainable in the long run, as soon as the location of a given ECR changes (e.g. following a URL change) any scraping script will break down. Instead, the ECR should be produced in a machine-readable format making it easily accessible to any party with a vested interest in embedded resources.

It is also worth adding that during 2023 the resource inclusion threshold will be lowered from 1MW to 50kW. This change will effectively triple or even quadruple the size of the ECR dataset for each network operator (estimate based on WPD figures), rendering the existing Excel sheet format inadequate in the long run.

Last but certainly not least, embedded resources are a crucial component of the UK's energy system. Consequently, digitalising the ECR as per recommendation 1 of the Energy Data Task Force [3] is effectively a step closer to achieving the Net Zero target.

Digitalisation options

The ultimate aim is to transform the ECR from its existing format to a REST API (REpresentational State Transfer Application Programming Interface). Without going into too many technical details, a REST API is effectively a vehicle that transports data from a database to a Client using the internet's request/response mechanism, also known as HTTP (Hyper Text Transfer Protocol) request/response. To avoid any confusion, a Client in this context can be a web application, an end user, or even another server. The diagram in figure 1 below shows the essence of how a REST API works.

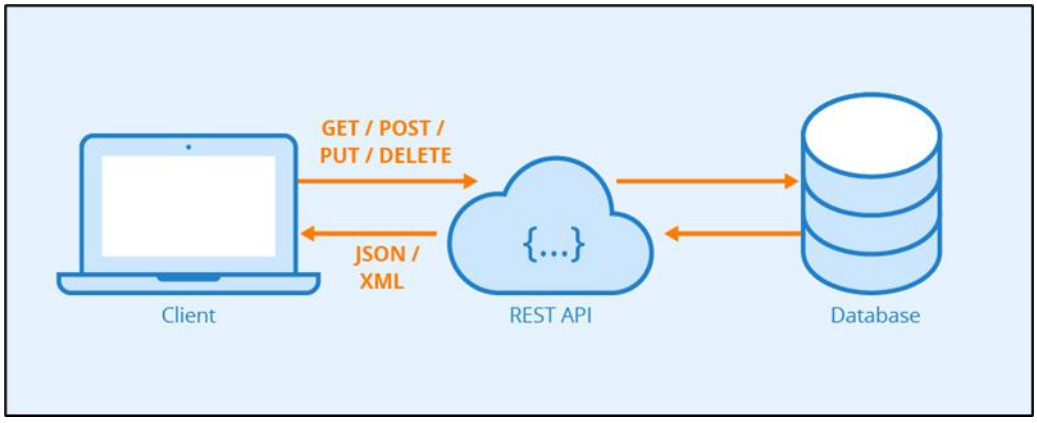

Figure 1 – Simplified REST API diagram. Credit: Astera (https://www.astera.com/type/blog/rest-api-definition/)

Foundational components

From a Client point of view, every REST API has a number of endpoints that can be thought of as a set of dedicated URLs acting as the interface. A request including the correct expected parameters can be sent to each endpoint by the Client. In return, the Client will receive a response containing the requested data in a specific format, usually JSON or XML but can also be CSV.

In order to successfully digitalise the ECR there are two pre-requisite components that must be implemented by each DNO:

- Component 1: a standardised machine-readable format. This component will extend the excellent work already done by WS2 P1 team to standardise the ECR albeit in Excel. The aim here is to make the data ingestion process by a Client as seamless as possible. This can be achieved by converting the ECR output to JSON or CSV, or even have both formats available. An example of these machine-readable formats can be seen in figures 2 & 3 below.

- Component 2: Creation of dedicated endpoints for the ECR. This is a natural dependency in order to successfully digitalise the ECR.
    - Endpoint examples:
        - https://<dno_website_address>/dataset/embedded-capacity-register/resource/latest.csv
        - https://<dno_cloud_server>/dataset/ecr/resource/latest.json
        - https://<dno_cloud_server>/ecr/month/{month}/year/{year}/format/{response_format}. In this example it is worth noting that values between curly brackets are the Client's input parameters. This is how a Client can request a specific subset of the ECR filtered on a given month, year, and a preferred response format (JSON or CSV)


```
{
 "issue_date":"10/10/2021",
 "resources": [
  {
    "export_mpan":2100040023638,
    "import_mpan": 2100040023637,
    "customer_name":"AB InBev UK Limited",
    "customer_site":"CE RUSH WALL TURBINE LIMITED",
    "address_line_1":"WHITBREAD BREWERY",
    "address_line_2":"MAGOR",
    "town_city":"NEWPORT",
    "county": "SHROPSHIRE",
    "x_location": 321941.398,
    "y_location": 162247.701,
    "gsp": "Uskmouth",
    "bsp": "Magor",
    "primary": "Trowbridge Primary",
    "poc_voltage": 11,
    "licence": "Western Power Distribution (South Wales) plc",
    "energy_source_1": "Wind",
    "energy_conv_tech_1": "Onshore wind turbines",
    "chp_cogen_1": "No",
    "storage_cap_1": 5,
    "es1_registered_cap": 10,
    "energy_source_2": "Solar",
    "energy_conv_tech_2": "Photovoltaic",
    "chp_cogen_2": "Yes",
    "storage_cap_2": 0,
    "es2_registered_cap": 2,
    "energy_source_3": null,
    "energy_conv_tech_3": null,
    "chp_cogen_3": null,
    "storage_cap_3": null,
    "es3_registered_cap": null,
    "flexible_connection": "No",
    "status": "Connected",
    "connected_registered_cap":
  }
],
```


Figure 2 - Example of an ECR record in JSON format

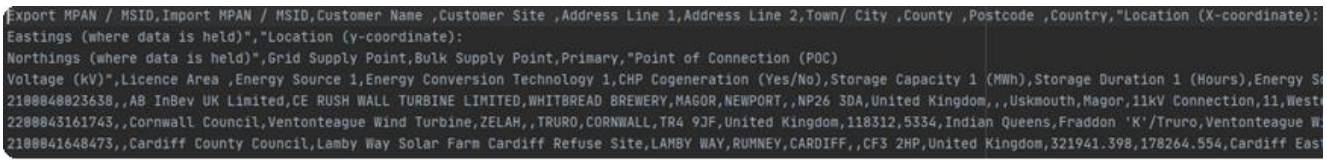

Figure 3 - Example of a few ECR records in CSV format

Implementing both components described above is a necessity in order to ensure that ECR data is shared and ingested in a very predictable and replicable manner.

Decentralised option

This option will ultimately provide ECR data directly from the DNO via a dedicated REST API. In order to achieve this, each DNO must implement the digitalisation pre-requisites mentioned in the sections above. This shouldn't be much of a challenge purely because REST APIs re inherently platform and language agnostic. What is meant by this is that every DNO should be able to implement a REST API dedicated to serving ECR data independently of their preferred technology stack or framework.

Here's a list of the advantages and disadvantages of this option:

- Advantages:
  - Will easily cope with increased volume of ECR data
  - Low overhead cost for each DNO
  - Low risk of data duplication and/or discrepancy
  - DNO remains source of the truth & custodian of the data
  - Simple yet powerful solution
- Disadvantages:
  - Stakeholders will need to pull data from multiple APIs nation-wide type analysis

Centralised option

This option will ultimately provide ECR data for all DNOs from a centralised database. A REST API will then serve ECR data from that centralised database. It must be emphasised that in order to implement a centralised solution, each DNO will still need to implement the digitalisation pre-requisites mentioned in the section above. As a consequence, implementing such a solution comes with a number of additional (perhaps unnecessary) challenges:

- Design & build a cloud-based architecture that will host the centralised database (backend)
- Upfront costs associated with implementing a cloud-based solution
- Ongoing hosting and maintenance costs
- The question of data ownership remains unanswered

Here's a list of the advantages and disadvantages of this option:

- Advantages:
  - Will easily cope with increased volume of ECR data

- Will provide a one-stop location for ECR data

- Disadvantages:
  - High upfront setup costs
  - Ongoing maintenance required
  - Risk of having duplicated data
  - Potentially longer implementation timescale
  - Complex solution with many “moving” parts

Recommendation

It is recommended to pursue the decentralised option for the following reasons:

- It delivers on the “Digitalisation of the Energy System” recommendation set out by the EDTF with relatively low cost, consequently yielding optimal value to DNOs and stakeholders
- From a technical point of view, it is far simpler to implement compared to the centralised solution
- The ENA would be able to signpost API endpoints for each DNO in a central document hosted on the ENA’s webpage related to the ECR
- It is reasonable to implement this solution by the end of 2022

Next steps or implementation plan

The following next steps are crucial in successfully delivering the ECR digitalisation strategy:

1. Finalise and agree on the structure of each machine-readable format (JSON & CSV) and ensure metadata is included.
2. Discuss the implementation phase with individual DNO, preferably with IT/application development personnel directly.
3. Testing and deployment of API endpoints for each DNO.

Update December 2022

Having undertaken more detailed analysis of the options to digitalise the ECR, DNOs are now recommending removing the requirement to have a single REST API blueprint. Rather, DNOs must be able to select their own endpoint design for a number of reasons:

A. DNOs have (or are) implementing their own data sharing platforms. In some cases, these are based on a SaaS (Software as a Service) platform which will not facilitate customisation of API endpoint designs.

B. Worse case for data consumers is that if they want UK wide data, they will have to implement 6 different API connectors. Given that DNOs have already agreed on the decentralised (rather than

centralised) model for ECR digitalisation, this would have been the case anyway. The only difference is that data consumers may not be able to develop a single API call design but will need to design their API calls specifically for each data portal they access.

C. A number of DNOs are either already committed to, or are considering, the same SaaS provider. In effect, this will create the REST API blueprint for data consumers to re-use for all those DNO's on the common platform and reduce the number of different API designs.

D. At this stage, it is not entirely clear what data consumers want from a digital ECR process. The revised approach will allow DNOs to deliver a digital ECR quicker and use this to enable data consumers to provide feedback.

E. There are other initiatives underway which might result in the ECR data being exposed through other mechanisms. For example, the DDSG's National Energy System Map (NESM) project might enable (a subset of) ECR data to be collated and presented in a UK wide platform. Again, DNOs can consider a revised approach in the light of other relevant activities as they develop.

F. DNOs have facilitated interoperability of ECR data through aligning data structures and definitions. At this stage, it is not clear that the effort required to facilitate technology alignment through the implementation of common APIs would deliver sufficient stakeholder benefit to justify the costs involved.

REFERENCES

[1] OFGEM, “DCP350 – Creation of Embedded Capacity Registers,” OFGEM, 1 July 2020. [Online]. Available: https://www.ofgem.gov.uk/publications/dcp350-creation-embedded-capacity-registers. [Accessed 6 January 2022].

[2] DCUSA, “Embedded Capacity Register,” DCUSA, 20 July 2020. [Online]. Available: https://www.dcusa.co.uk/dcusa-document/related-documentation/embedded-capacity-register/. [Accessed 07 January 2022].

[3] Energy Systems Catapult, “Energy Data Taskforce: A Strategy for a Modern Digitalised Energy System,” Energy Systems Catapult, 9 July 2019. [Online]. Available: https://es.catapult.org.uk/report/energy-data-taskforce-report/. [Accessed 7 January 2022].

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