ALGORITHM GOVERNANCE

A BRIEFING

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1. INTRODUCTION

As noted by the Energy Digitalisation Taskforce[1] (EDiT), it is essential that the sector proactively manages new digital risks such as the increased prevalence of algorithmic decision making. In addition, there needs to be some level of oversight of the potential of "cascade" impacts across multiple algorithms. This briefing paper builds on the work of the EDiT report, specifically the recommendation on Algorithm Governance, setting out how this recommendation could be implemented, along with a providing more context around the use of algorithms in the energy sector.

> *'Algorithms are routine processes or sequences of instructions for analysing data, solving problems, and performing tasks. Traditionally, researchers "programmed" algorithms to perform certain tasks. "Self-learning" algorithms, however, are increasingly replacing programmed algorithms[2].'*

This paper and its recommendations are primarily concerned with algorithms that have minimal human intervention or direct oversight during a decision-making process.

Wider discussion can be found through the Digital Regulation Cooperation Forum's paper on Auditing Algorithms[3], which sets out a longer form dive into how regulators can approach ensuring algorithms do not have unintended consequences, such as poor or discriminatory consumer impacts, or create system failures.

1.1. RECOMMENDATIONS

To meet the challenges of a growing number of automated decisions being made about the energy system, and to reduce the risk of cascade impacts – an **Algorithm Metadata Standard should be adopted**, along with a system to **register those algorithms** in a way that ensures all relevant organisations can access that information to do their own risk analysis and mitigation. Combined, these two recommendations put in place the foundational information required, as well as a means to access it – to enable stronger governance of algorithms to be built over time. More detail is provided in section 3 of this document which outlines a metadata standard as well as a delivery mechanism for registration of algorithms.

1.2. WHAT IS ALGORITHM GOVERNANCE

The development of algorithms that operate with minimal human intervention within the energy system will be an increasingly common occurrence, particularly as flexibility markets develop. In addition, large numbers of behind the meter devices will be incorporated into smart systems, utilising automation, machine learning and other techniques from the data produced by these devices to optimise for consumers, networks, and whole system outcomes.

The utilisation of these algorithms will be necessary to manage the complexity of the energy system and in managing user preferences for how people utilise their home and assets. Their use however does then necessitate monitoring by a variety of market participants, principally the

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[1] https://es.catapult.org.uk/report/delivering-a-digitalised-energy-system/
[2] https://www2.deloitte.com/content/dam/Deloitte/us/Documents/risk/us-risk-algorithmic-machine-learning-risk-management.pdf
[3] https://www.gov.uk/government/publications/findings-from-the-drcf-algorithmic-processing-workstream-spring-2022/auditing-algorithms-the-existing-landscape-role-of-regulators-and-future-outlook#introduction-and-purpose

regulator and system operator(s), to help map and manage the interdependencies between the various algorithms in use by the sector and reduce systemic risks from developing undetected.

The Office of the Comptroller of the Currency (OCC) provides guidance on a similar approach for effective management of risks that arise when using quantitative models which are used in bank decision making[4]. Guidance from OCC highlights the need for proper governance of banking models, with residual risks from the models to be managed through other processes. By taking a similar, albeit whole system approach to monitoring algorithms, the increasingly decentralised energy system would be able to assess the risks associated with algorithms on their own services and systems. The regulator, and system operator(s) by comparison, could take a market wide view and intervene as appropriate.

1.3. OPPORTUNITIES AND RISKS

The deployment of algorithms across the energy sector will be a prerequisite of the future energy system. The complexity of consumer choice alone means that automated decision-making based on user inputs, forecasts and models will be necessary for the operation of the energy system. This creates ample opportunities to create a more engaged, dynamic energy system which accounts for the considerable variety in energy use patterns through the transition to a net zero economy. This could manifest in more bespoke consumer offerings and incentives, or in new types of market for organisations seeking to deploy energy generation or storage at scale.

Cataloguing the variety of algorithms that underpin the energy system will be enable those responsible for its operation to develop a deeper and shared understanding of how the systems and processes that underpin it are reliant on algorithms. Effective use of algorithms can enable several positive outcomes, such as:

- Enabling high frequency decisions to be made without manual intervention to assist balancing the energy system
- Allowing for consumer choice and confidence that their preferences will be catered for
- Creating new markets for energy products and services
- Network managers can transition towards more anticipatory outcomes, rather than reactive.

In cataloguing these algorithms, the regulator and system operator(s) gain a mechanism through which they can ascertain information about the technical operation of the sector, conduct risk analyses and develop robust governance to mitigate any issues. The deployment of algorithms, without oversight at a sectoral level could cause issues that will need to be understood such as:

- Cascade impacts across the energy system derived from the interactions between algorithms
- Bias or discrimination against individuals or groups
- Distortion or manipulation of markets

Before the design and implementation of an algorithm itself, the biggest factors that contributes to the success or failure of an algorithm is the data and assumptions that feeds its decision-making process. While not the purpose of this brief, it is still imperative to note that success of any algorithm could be determined by the underlying data, its size and how representative it is – and therefore the industry continuing its journey on data openness, standards & licensing is key.

[4] https://www.occ.gov/news-issuances/bulletins/2011/bulletin-2011-12.html

2. ALGORITHMS IN THE ENERGY SYSTEM

As the energy system is digitalised and more energy assets become active participants in the energy system, the use of algorithms to directly control energy assets will increase. This is not only likely, but it is desirable because algorithms will enable energy assets to be effectively utilised to deliver a decarbonised, balanced, and stable energy system whilst minimising the need for active human intervention. Customers will be able to dictate their preferences and allow algorithms and digital system to operate their assets in a way that meets their goals e.g., comfort, carbon reduction, cost profile, etc.

However, as the number of algorithms increases there is a growing risk that issues or failures will cause system wide consequences. For example, if the charge control algorithm for a large-scale EV operator was to malfunction there is a risk that they could destabilise the system and cause widespread power outages. The need to minimise these systemic risks is increasing daily as more distributed energy assets are installed and utilised behind the meter.

There are some examples of algorithms operating in or around the energy system today. Arenko Group, for example, has a software platform which deploys algorithms on top of operational data from batteries and renewable assets to optimise against physical positions, technical performance, and/or market volatility. This proprietary software, and services akin to it are specifically designed to model real systems and make automated, optimised decisions for their clients and solve for any constraints placed on their operation in particular markets.

How services like Arenko's interact with their software competitors, or other deployed algorithms by system operators, including the cascade impacts between algorithms, systems and markets is not well understood by system operators as it has not been an established issue to date. This poses a growing risk to the sector, as more service providers respond to market signals with flexibility in an automated way.

Similarly, algorithms which monitor operational conditions and predict generation are increasingly utilised by system operators. For example, Open Climate Fix[5] are developing algorithms that use statistical or machine learning techniques to take recent weather observations and satellite images and roll them forwards. This enables system operators to more accurately gauge where spinning reserve is required (and not) and therefore better optimise the system. These optimisation algorithms will be increasingly important as the renewable intensive energy system develops and will require careful management to ensure that unintended consequences do not have system wide impacts.

[5] https://www.openclimatefix.org/

3. ALGORITM METADATA STANDARD

To reduce the risk of failures across the energy system, visibility of those risks by system operators will be incredibly important. A new metadata standard approach, along with a requirement to register algorithms could be implemented by Ofgem though the system operator or DSO license(s), to ensure the system operators have sufficient visibility of the issue and can create appropriate systems, processes, and mitigations.

3.1. METADATA SOLUTION

The metadata standards for algorithms (and downstream algorithms which provide significant inputs) which can materially influence the operation of the GB energy system should conform to a set of metadata standards. This includes, but is not limited to, algorithms responsible for:

- Dispatching energy from generation or storage assets
- Modulating demand from flexible energy assets
- Requesting or coordinating response from energy assets
- Active network management control
- Maintaining a balanced and stable energy system e.g. frequency, voltage or inertia control

It is essential for the regulator to have sufficient visibility of algorithms that are essential to the smooth operation of the energy system such that it is possible to identify and manage a variety of risks such as operation or supply chain. Given algorithm metadata registration is a lightweight requirement and should therefore apply to all non-trial scale systems. e.g., Algorithms that can control assets equivalent to more than 1% of peak demand in any GSP area.

Algorithms in scope should register a minimal set of algorithm metadata which should be updated at least once per quarter or where there is a 'major release' or where there is a significant change in the assets being controlled.

The regulator should provide digital tools to enable organisations to easily submit this data on a regular basis, ideally in a way that is as automated as possible. The system should streamline resubmission by representing the latest record for editing or confirmation and should enable algorithms to be 'decommissioned' when they fall out of use. Similarly, the metadata captured will have relevance over time. It is therefore expected that any algorithm registration solution should be able to view historical submissions.

<u>Definitions</u>

We have built on the GDPR definitions to define Algorithm Controller and Algorithm Processor to support these proposals.

Algorithm Controller: the natural or legal person, public authority, agency or other body which, alone or jointly with others, determines the purposes of the algorithm

Algorithm Processor: a natural or legal person, public authority, agency or other body which develops, maintains or operates the algorithm on behalf of the Algorithm Controller.

<u>Algorithm Metadata proposal</u>

Field	Type	Example
Date	Date	01/01/2022
Algorithm Name	Text	TeSTeR

Algorithm unique ID	Number	0000012
Algorithm Controller	Text	Company A
Algorithm Processor(s)	Text	Company B
Algorithm Owner – Name	Text	Jo Bloggs
Algorithm Owner – Job Title	Text	Data Scientist
Algorithm Assumptions	Text (Max 200 words)	The algorithm works under the assumptions that a) the data provided to feed this is clean b) forecasting has a 95% accuracy over y period and…
Primary Use Case	List [Energy Dispatch, Demand Flexibility Control, System Operation, Market Management, Market Facilitation, etc.]	Demand Flexibility Control
Energy Vector	List [Power, Natural Gas, Hydrogen, etc.]	Power
Energy Assets Controlled (Number)	Number	43
Domestic Energy Assets Controlled (Energy)	Number (Mwh)	0.56
Domestic Energy Assets Controlled (Power)	Number (Mw)	0.215
Non-Domestic Energy Assets Controlled (Energy)	Number (Mwh)	0.83
Non-Domestic Energy Assets Controlled (Power)	Number (Mw)	0.31
Geographic Region	Geospatial Identifier	UK (National)
Algorithm Type	List [Deterministic / Probabilistic, Machine Learning, Reinforcement Learning]	Machine Learning
Retrain / Update Rate	Time period	Daily
Source Code (If open source)	URL	Github.com/code
Dependencies	Text	Describe any dependencies this algorithm has, including referencing any algorithm unique ID that appears on the ledger if appropriate.

Extended Metadata proposal

Field	Type	Example
Accountable Executive (Name)	Text	Alex Bloggs
Accountable Executive (Job Title)	Text	Chief Technology Officer
Describe your algorithm / model development / procurement process.	Text (max 200 words)	Algorithm developed in house following the Turing Way guidelines

Describe your algorithm / model risk assessment process.	Text (max 200 words)	We use the model risk management developed by Company B
Describe the biggest risks of the algorithm / model and how have these been mitigated.	Text (max 200 words)	The biggest risk identified was the lack of data during low wind production which means that…
What is your security approach?	Text (max 200 words)	We are ISO 270001 certified and follow all aspects of the standard…
What other algorithms does your algorithm interact with?	Text (max 200 words)	Flexibility platform control system (company C) Wholesale price forecasting model (Company A)
Describe your algorithm monitoring approach and how you identify issues.	Text (max 200 words)	Our algorithm is logged and monitored 24/7 with key thresholds used to identify suspect input data and outputs
Describe your revalidation process (i.e., when was this algorithm last benchmarked, and how did it perform against those benchmarks)	Text (max 200 words)	Our algorithm is benchmarked using dataset X every 6 months, testing specifically for y & z variables.

3.2. REGISTRATION SOLUTION

Registering algorithms centrally and enabling all relevant organisations visibility of these algorithms is an important step in being able to view, assess and respond to the risks posed by relevant algorithms in the energy sector. There are many implementations of repositories of data or metadata, for example through a ledger, either centrally owned and operated, or via a distributed technology. Given other work ongoing in the sector; specifically, EDiT's "digital spine" recommendation, a spine and node implementation of a central ledger would be preferred to reduce implementation costs and continue to develop common digital infrastructure. Building a metadata library of algorithms could form one use case in the development of an overall energy system digital spine.

Through this solution, organisations in the sector would upload information relating to their algorithms via the digital spine – with permissions control as specified by the org, in line with any potential licence conditions, or other regulatory mechanism, used to implement this requirement on organisations. This approach would utilise the API development standards emergent from utilizing the digital spine solution, reducing overall implementation costs for every org submitting or receiving information relating to registered algorithms. BEIS's recent announcement that they intend to create regulation on DSR to be managed by Ofgem[6] would be a prime candidate to insert requirements on capturing information on relevant algorithms, though this would only include domestic and small business DSR, and further regulation would be needed to capture other actors who fall outside this regulatory scope.

6 https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1088796/smart-secure-energy-system-consultation.pdf

4. SUMMARY

The development and use of algorithms across the energy sector is expected to continue to grow as more devices are connected to smart systems and the need to flexibly manage demand increases. These algorithms come with a swathe of benefits, such as enabling high frequency decision making to occur, embedding consumer choice into system decisions, and creating new markets for products and services. However, if left unmonitored the deployment of algorithms across the sector could cause cascade impacts across the energy system, embed bias or discrimination, or distort markets.

It is important that the regulator and system operator(s) have sufficient visibility of what algorithms are being utilised in the sector where there is no direct oversight or manual intervention. By mandating and utilising a metadata standard in conjunction with a registration solution – those organisations who require oversight of algorithms to make effective decisions about the energy system will be able to begin building knowledge and creating processes, systems, and procedures to ensure the use of algorithms is a lower risk, high benefit endeavour for the energy transition. Over time, this knowledge can be leveraged to create stronger governance mechanisms, however in the first instance, industry need to get a grasp on the emerging issues ahead of time.

OUR MISSION

TO UNLEASH INNOVATION AND OPEN NEW MARKETS TO CAPTURE THE CLEAN GROWTH OPPORTUNITY.

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