Digital Sustainability and AI – Guidance for project teams

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Audience: APHA, Defra, Environment Agency, Marine Management Organisation, Natural England, RPA, VMD

Department for Environment Food & Rural Affairs

Digital Sustainability and Artificial Intelligence (AI)

Guidance for project teams

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Scope and definition of AI

This guidance adopts the latest definition of AI as adopted by OECD countries:

> An AI system is a machine-based system that, for explicit or implicit objectives, infers, from the input it receives, how to generate outputs such as predictions, content, recommendations, or decisions that can influence physical or virtual environments. Different AI systems vary in their levels of autonomy and adaptiveness after deployment.

This definition extends the definition provided in the current Defra group AI Strategy and aligns more closely with the one used by the Central Digital and Data Office.

While this definition and guidance may be broadly applicable to a range of AI applications, the focus is on more complex applications incorporating deep learning models that are more intensive, such as:

- predictive modelling
- image recognition
- speech and sound recognition
- natural language processing
- generative tools (including text, image and video generation)

This guidance covers organisations within Defra group that use Defra Group Corporate Services.

Guidance for project teams

This guidance is for addressing the sustainability considerations described in the Defra Digital Sustainability and Artificial Intelligence (AI) position statement.

You should follow the guidance and address each point in your design documentation and approval process if you plan to use AI.

It will not be possible to consider all these points simultaneously, but you should address them as the project goes from business case to high-level and low-level design.

Where a supplier is providing the AI tooling, they should consult this guidance, as it could form part of the supplier selection and procurement process.

1. Consider whether AI is necessary

This section is applicable to all staff involved in AI proposals.

Understand why your proposal needs AI

As part of your requirements analysis, consider what additional benefit AI would deliver compared to other less intensive solutions. Could you achieve the same outcome through alternative means?

Consider the environmental benefits

Make sure you consider environmental benefits, such as reducing emissions, waste generation or the use of utilities alongside business benefits and value for money.

Consider the environmental costs

These should include:

- greenhouse gas emissions
- water usage
- change in land use
- effects on biodiversity and the circular economy

Consider the rebound effect, understanding that lower costs and increased efficiency can lead to increasing adoption and use. This amplifies the environmental effect of the technology.

2. Choose the right AI pipeline

Be clear on what the AI will achieve

You should specify at the beginning what the purpose of the AI will be – for example, whether it will collect data, interpret information, automate tasks, generate new content, or something else. Limit its scope to the essential inputs and outputs you need at specific points in your service.

Choose the minimum viable model

Wherever possible, investigate and choose the model with the lowest computing cost that produces outputs of acceptable quality and accuracy for your needs. For example, consider using GPT-4o mini over GPT-4o.

Tools such as AI Energy Score can help you choose the right AI model based on their energy usage.

Choose the minimum required modality

'Multimodal' AI models can work with several types of data, such as images and text. Where possible, use AI models with only the modality you need for your project. For example, a chat-bot AI application will not need a model that can generate images.

Reuse a pre-trained model or choose a model that requires minimal training

Reuse pre-trained models where possible to reduce costs associated with training AI. You can then finetune for your needs.

If you need to train a model, do this at off-peak times or overnight, as demands on the energy grid will be lower at these times.

Make sure information and data is used appropriately

If you need to train a model, avoid collecting unnecessary data and check if the data has already been collected elsewhere.

You should:

- review data regularly to delete redundant data and archive information you do not access often
- refine, compress and quantise datasets to minimize their footprint
- identify opportunities for better data sharing, processing and reusability within and across projects and programmes

Use your AI model efficiently and precisely

Only use your AI model for the most appropriate decision points. Use conventional methods for other parts of your service.

Limit how often your use AI models by making sure your queries are as specific as possible. Use prompt engineering and other refinement techniques to help you.

Measure the sustainability of your AI model

Use AI model performance metrics to evaluate your model and consider other sustainability metrics such as Software Carbon Intensity (SCI). You should measure your model during training and inference at a minimum.

Use an emissions calculator such as Green Algorithms to help estimate the carbon footprint of your model and include this in project reporting.

Where possible, include carbon tracking tools such as EcoLogits or CodeCarbon in your code to monitor emissions more accurately in real time.

3. Choose the right infrastructure

This section is applicable to staff involved in architecture and service management for AI proposals.

Make sure the infrastructure can be scaled for the future of your service

Consider the scaling of your service over time and account for this in your hosting choice. This will avoid the need to commission new infrastructure or procure hosting services that may be less sustainable.

Use infrastructure that is constructed sustainably

Find out if your server or data centre has been constructed efficiently. For example, check whether it has used low-emission practices or recycled materials in its construction. You might be able to find this in the data centre's sustainability accreditations.

Choose a suitable location for your infrastructure

Where possible, make sure the data centre is:

- in a temperate region with less need for cooling
- powered by a national electricity grid with a good and regular renewable energy supply
- in an area with good water security and availability

Choose infrastructure that is energy efficient

If you need a data centre, compare the power usage effectiveness (PUE) and carbon usage effectiveness (CUE) metrics of potential candidates.

To maximise efficiency, consider whether the infrastructure makes efforts to optimise computing and data transfer, such as through virtualization, multi-node systems, edge computing or container orchestration tools. Also consider whether the data centre is 'AI enabled' with specialized AI processors.

Choose infrastructure that uses water efficiently

Consider whether the infrastructure uses:

- an efficient cooling system, such as a liquid or precision cooling system or hot and cold aisles
- methods to recycle waste heat, such as combined heat and power (CHP) technology

Where possible, investigate the water usage effectiveness (WUE) of data centres and whether they employ a closed-loop water system. Consider that lower WUE often comes at the expense of higher PUE and vice versa. You might need to make a trade-off based on a location's water stress and grid composition respectively, while also futureproofing against drought or flood risk.

Plan how to decommission redundant technology sustainably

If you are replacing an existing service, fully consider the end-of-life options for any hardware you will decommission in accordance with the waste hierarchy. For example, components could be reused or recycled for their materials.

Choose infrastructure that is managed sustainably

Investigate the governance behind your hosting service. For example, consider whether the service has an infrastructure management strategy or a waste management and recycling strategy.

Prioritise hosting solutions that have environmental certifications such as BREEAM or ISO 14001.

4. Ensure social value

This section is applicable to staff involved in commercial and supplier management for AI proposals.

Check for labour exploitation in your supply chain

Investigate the labour practices for potential suppliers of both AI models and hosting infrastructures, especially when they outsource the training or data annotation of models.

Consider whether candidates have a modern slavery statement or have made specific commitments to address labour exploitation in their supply chain.

Check your supply chain contributes social value

Investigate the social value commitments of any potential suppliers. For example, consider initiatives in place to create jobs and apprenticeships, address social inequality or protect the environment. Apply the appropriate weighting of these considerations within any procurement decision.

5. Ensure ownership and monitoring

This section is applicable to staff involved in project and service management for AI proposals.

Appoint a service owner to track and deliver the sustainability costs and benefits

Identify a responsible owner as early as you can.

Make sure they understand their responsibility to manage sustainability across the service. The team responsible for the AI proposal should put resilience measures in place to anticipate if the responsible owner becomes unavailable.

Governance and process

Any deployment of AI within Defra group should be part of the Digital, Data, Technology and Security (DDTS) governance process (overseen by the DDTS Portfolio team). This process includes clear approvals for design and implementation of technology solutions and a requirement for all projects to complete a digital sustainability assessment.

The DDTS Digital Sustainability team will work with the DDTS Architecture and Portfolio team to embed this guidance into the appropriate project and architecture documentation so it becomes part of the business-as-usual process for AI deployments.

The Defra Digital Transformation Board will review this guidance annually to make sure it reflects the latest risks, opportunities and best practice for sustainable AI.