Strategic Command
Defence Support

Operational Energy Authority

Energy Insights Function

Industry Engagement
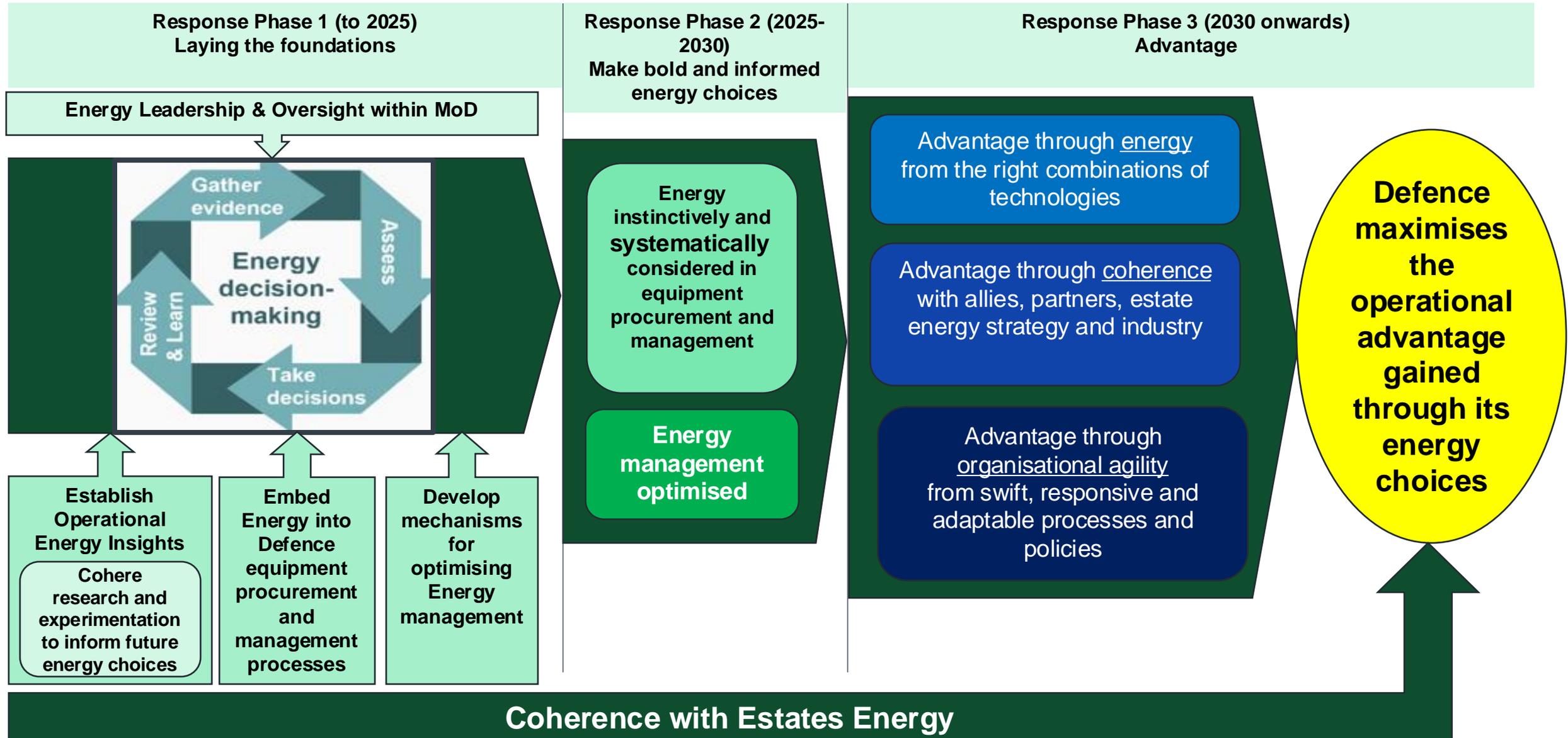
16 Oct 24

Introduction

Today's Aim & Objectives

Aim: To inform selected Industry partners/potential partners of work to date to develop a Defence Energy Insights Function and seek advice/feedback on the concept and further development, particularly where Industry may be able to assist with capabilities and/or advise on potential associated costs to inform future funding bids.
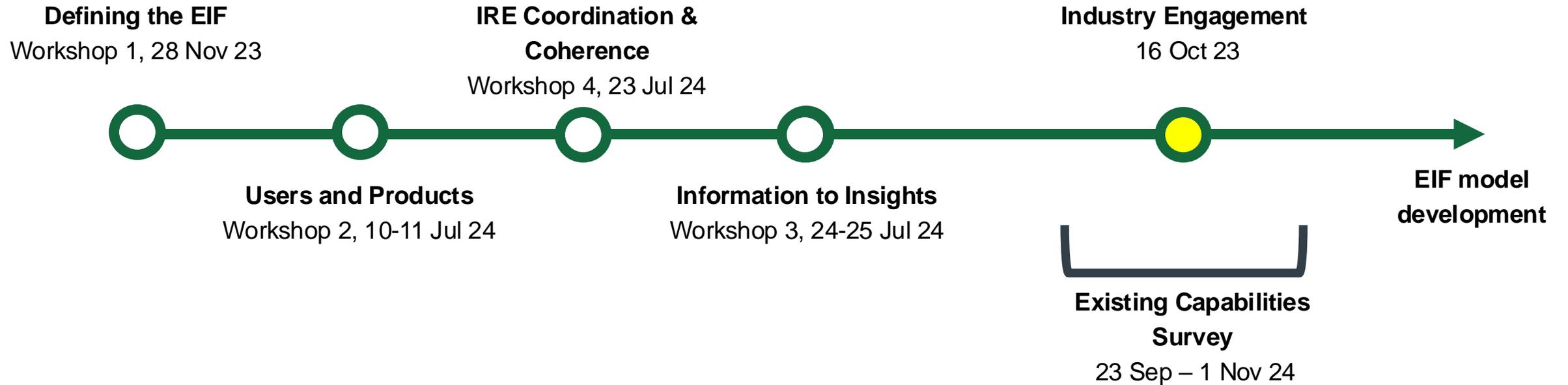
Objectives:
• To build awareness of the Energy Insights work and its broader context amongst partners/potential partners in the relevant sectors of Defence Industry;
• To review and seek Industry's feedback on the work to date;
• To identify where Industrial partners/potential partners may have or be able to develop relevant required capabilities; and
• obtain Industry feedback/advice on likely associated costs (to inform future funding bids).

The Defence Operational Energy Strategy

Response Phase 1 (to 2025) Laying the foundations	Response Phase 2 (2025-2030) Make bold and informed energy choices	Response Phase 3 (2030 onwards) Advantage

Energy Leadership & Oversight within MoD

Energy decision-making
- Gather evidence
- Assess
- Take decisions
- Review & Learn

Establish Operational Energy Insights

Cohere research and experimentation to inform future energy choices

Embed Energy into Defence equipment procurement and management processes

Develop mechanisms for optimising Energy management

Energy instinctively and systematically considered in equipment procurement and management

Energy management optimised

Advantage through energy from the right combinations of technologies

Advantage through coherence with allies, partners, estate energy strategy and industry

Advantage through organisational agility from swift, responsive and adaptable processes and policies

Defence maximises the operational advantage gained through its energy choices

Coherence with Estates Energy

DOES Priority Action 2 – The EIF Design Journey

Defining the EIF
Workshop 1, 28 Nov 23

Users and Products
Workshop 2, 10-11 Jul 24

IRE Coordination & Coherence
Workshop 4, 23 Jul 24

Information to Insights
Workshop 3, 24-25 Jul 24

Industry Engagement
16 Oct 23

Existing Capabilities Survey
23 Sep – 1 Nov 24

EIF model development

Energy Insights Function Model V1.12

Key

Initial Purpose Pathway and Activities
Secondary Benefits
Feedback Loops
Insights Function

Feedback

Wargaming   Concepts   Policy   Strategy   **Bold capability decisions**

Also informs

Directs and reshapes

Insights Function
SME knowledge of the energy landscape

Horizon-Scanning

Information and Evidence

Awareness of Threat

Accessible Repository of Energy Information

Analyse Fuse Synthesise *Contextualise*

Accessible Energy Insights

Which identify:
Energy vectors most likely to prevail?
Knowledge / Energy vectors most promising for Defence Risks, issues, opportunities
Key considerations
Key decision points

Advises

Whole Broader Acquisition Process / Equipment Programme from Pre-Concept to Disposal

Acquisition Process and Energy Governance

Governance

Advises   **Climate Change & Environmental Opportunities**

Advises   **Defence Estates Energy Hub**

Coheres and Coordinates Energy Innovation Research and Experimentation, to shape

Energy S&T Agenda (through DSFDB)

Provides consistent feedback   **Industry**

DIKW model, representing the relationships between data, information, knowledge and wisdom, as reflected in the Energy Insights Function

Data   *Information*   *Knowledge*   *Wisdom*

Possible Technology Solutions (1)

Collect and Integrate

Smart Meter Collection
Smart meter collection refers to the systematic gathering of consumption data from smart meters, which measure typically electricity, gas, and water usage in a domestic or commercial setting at precise intervals and communicate this data to the central system.

International Partner Data Feeds
International partner data feeds include information shared by global energy partners, covering cross-border energy trade, international market trends, and regulatory developments.

Advanced Metering Infrastructure (AMI)
Advanced Metering Infrastructure (AMI) encompasses the technology and systems that allow for automatic, two-way communication between energy meters and utilities. This infrastructure includes smart meters, communication networks, and data management systems.

Geographic Information Systems – Integration (GIS-I)
Geographic Information Systems Integration (GIS-I) refers to the process of merging spatial data with other types of energy data to provide a geographically contextualised view of energy operations.

Energy Efficiency Programme Data
Energy efficiency programme data includes information collected from initiatives aimed at reducing energy consumption through more efficient technologies, practices, and behaviours.

Internal Energy Partners
Internal energy partners refer to various departments or teams within the organisation that contribute data, insights, and expertise related to energy operations.

Data Security Protocols
Data security protocols are the measures and standards put in place to protect sensitive energy data from unauthorised access, breaches, and other cyber threats.

Social Media Data Analysis Approach
Social media data analysis involves systematically examining data from social platforms to gauge public sentiment, customer feedback, and emerging trends within the energy sector.

Selected 3rd Party Feeds
Selected third-party feeds refer to specialised data streams obtained from external providers, offering unique insights such as market analytics, environmental assessments, or consumer behaviour data.

Mobile Applications Data
Mobile application data refers to the information gathered from customer interactions with energy-related mobile apps, including usage patterns, preferences, and feedback.

Distributed Energy Resource (DER) Monitoring
Distributed Energy Resource (DER) monitoring involves the oversight and analysis of small-scale, decentralised energy sources such as solar panels, wind turbines, and energy storage systems.

Weather and Environmental Data
Weather and environmental data include information on climate conditions, weather patterns, and environmental factors that impact energy production, distribution, and consumption.

Supply Chain Data Integration
Supply chain data integration involves the consolidation of data from across the energy supply chain, from production to delivery, to provide a comprehensive view of operational efficiency and resource flows.

Academia
Academia refers to the contributions of universities and research institutions in providing cutting-edge research, case studies, and theoretical advancements related to energy systems and technology.

Industry Energy Data Feeds
Industry energy data feeds are streams of information provided by various entities within the energy sector, including market trends, operational data, and technological advancements.

IoT Devices and Sensors
Internet of Things (IoT) devices and sensors are connected technologies embedded within energy systems that collect and transmit data on various environmental and operational parameters.

Customer Segmentation Data
Customer segmentation data involves the categorisation of customers based on specific criteria such as energy usage patterns, demographics, and behaviour, to tailor services and products effectively.

Possible Technology Solutions (2)

Process and Manage

Data Warehousing Data warehousing refers to the storage and management of vast amounts of structured data in a centralised repository, optimised for query and analysis.	**Data Fusion Techniques** Data fusion techniques involve the integration of data from multiple sources to create more accurate, consistent, and comprehensive datasets for analysis.
Edge Computing Edge computing involves processing data closer to the source of data generation, such as sensors and IoT devices, rather than relying solely on centralised data centres.	**Efficiency Benchmarking** Efficiency benchmarking is the process of comparing an organisation's energy performance against industry standards or best practices to identify areas for improvement.
Data Cleaning and Transformation Pipelines Data cleaning and transformation pipelines refer to the automated processes that cleanse raw data of inconsistencies, errors, and redundancies while converting it into a usable format for analysis.	**Advantage Shaping** Advantage shaping refers to the strategic use of data and insights to create a competitive edge in the market, often by identifying unique opportunities or optimising operations in ways that differentiate the organisation from its competitors.
Data Lakes Data lakes are large repositories that store vast amounts of raw, unstructured, and structured data in its native format until it is needed for analysis.	**Advanced Load Forecasting Models** Advanced load forecasting models are predictive algorithms that estimate future energy demand based on historical data, weather patterns, economic factors, and other relevant variables.
Data Governance and Compliance Data governance and compliance involve the frameworks and practices that ensure data is managed, used, and protected according to regulatory requirements and organisational policies.	**Big Data – Renewable Integration** Big data for renewable integration refers to the use of extensive datasets and advanced analytics to incorporate renewable energy sources like solar and wind into the energy grid.
Real-Time Energy Consumption Data Real-time energy consumption data refers to the continuous collection and analysis of energy usage information as it happens, without delays.	**Demand Management Optimisation** Demand management optimisation involves the strategic control and adjustment of energy consumption patterns to align demand with supply, often in response to grid conditions or pricing signals.

Possible Technology Solutions (3)

Analyse and Model

Machine Learning Machine learning (ML) refers to the application of algorithms that allow systems to learn from data, identify patterns, and make decisions with minimal human intervention.	**Collaborative Filtering** Collaborative filtering is a method commonly used in recommendation systems, which predicts user preferences by analysing patterns of behaviours or interactions among users.
Large Language Models Large Language Models (LLMs) are advanced AI models trained on vast corpora of text data, enabling them to understand, generate, and respond to human language in a highly sophisticated manner.	**Causal Inference and Impact Evaluation** Causal inference methods aim to determine the cause-and-effect relationships between variables, while impact evaluation assesses the outcomes of specific interventions or policies.
Time Series Analysis Time series analysis involves the examination of data points collected or recorded at specific time intervals to identify trends, seasonal patterns, and other temporal dynamics.	**Network Analysis** Network analysis involves studying the relationships and interactions between different entities within a system, often represented as nodes and links in a graph.
Anomaly Detection Anomaly detection refers to the identification of data points, events, or observations that deviate significantly from the norm, indicating potential issues, opportunities, or novel patterns.	**Predictive Maintenance** Predictive maintenance uses data analytics to predict when equipment will require maintenance before a failure occurs, allowing for proactive management.
Simulation and Scenario Analysis Simulation and scenario analysis involve creating models to explore potential outcomes under various hypothetical situations, allowing organisations to assess risks, test strategies, and make informed decisions.	**Sentiment Analysis** Sentiment analysis involves the use of natural language processing to determine the emotional tone behind a body of text, such as social media posts or customer feedback.
Optimisation Algorithms Optimisation algorithms are mathematical techniques used to find the most efficient or effective solution to a problem, given a set of constraints and objectives.	**Cloud-Based Modelling and Simulation** Cloud-based modelling and simulation refers to using cloud computing resources to run simulations and models that require significant computational power.
Interactive Dashboards Interactive dashboards are dynamic, user-friendly interfaces that display data visualisations and key performance indicators, allowing users to explore and interact with data in real time.	**Crowdsourced Data Analysis** Crowdsourced data analysis involves leveraging the collective intelligence and efforts of many people or external contributors to analyse.
Geospatial Visualisations Geospatial visualisations are graphical representations of data that are mapped to specific locations, providing insights into spatial patterns and relationships.	**Explainable AI (XAI)** Explainable AI involves AI models that provide clear, understandable explanations for their predictions or decisions.
AR/VR Overlays Augmented Reality (AR) and Virtual Reality (VR) overlays involve the use of technology to superimpose digital information onto the physical world (AR) or create fully immersive virtual environments (VR) for enhanced data interaction and analysis.	

Possible Technology Solutions (4)

Generate (Insights) and Interpret

Dashboard Development
Dashboard development involves designing and building interactive, visual interfaces that consolidate and display key performance indicators (KPIs), metrics, and data visualisations, enabling users to monitor and analyse complex data in a clear and concise manner.

Quantum Computing Simulations
Quantum computing simulations leverage the principles of quantum mechanics to perform complex computations at speeds unattainable by classical computers, particularly useful for solving problems involving massive data sets and complex variables.

Natural Language Processing (NLP)
Natural Language Processing (NLP) is a branch of artificial intelligence that focuses on the interaction between computers and human language, enabling machines to understand, interpret, and generate human language in a meaningful way.

Automated Feature Engineering
Automated feature engineering is the process of automatically selecting, modifying, or creating features from raw data to improve the performance of machine learning models.

AI-Powered Recommendations
AI-powered recommendations involve the use of artificial intelligence algorithms to suggest actions, products, or strategies based on historical data, user behaviour, and other relevant factors.

Generative Models
Generative models are a type of machine learning model that can generate new data instances that resemble the training data, often used for simulating scenarios or creating synthetic data.

Predictive Analytics
Predictive analytics involves the use of statistical algorithms and machine learning techniques to analyse historical data and make predictions about future events or behaviours.

Cognitive Computing
Cognitive computing refers to systems that mimic human thought processes in a computerised model, often combining AI, machine learning, and natural language processing to solve complex problems.

Ensembles
Ensembles refer to a machine learning technique that combines the predictions from multiple models to improve accuracy and robustness compared to any single model.

Federated Learning
Federated learning is a machine learning technique that allows models to be trained across multiple decentralised devices or servers while keeping the data local, enhancing privacy and security.

Probabilistic Forecasting
Probabilistic forecasting involves predicting future events or values along with the associated probabilities, providing a range of possible outcomes rather than a single point estimate.

Hybrid Modelling
Hybrid modelling combines different types of models (e.g., statistical, machine learning, and physical models) to leverage the strengths of each and create a more accurate and reliable overall model.

Digital Twins
Digital twins are virtual replicas of physical assets, systems, or processes that use real-time data and advanced simulations to mirror and predict the behaviour of their real-world counterparts.

Behavioural Modelling
Behavioural modelling refers to the simulation and analysis of human behaviour patterns, often using data from social sciences, psychology, or customer interactions.

Possible Technology Solutions (5)

Visualise, Represent and Communicate

Storytelling with Data Storytelling with data is the practice of using data visualisations and narrative techniques to communicate insights in a compelling, relatable, and easily understandable manner.	**Sentiment Analysis** Sentiment analysis is the process of using natural language processing and machine learning to identify and quantify the emotional tone within a body of text, such as social media posts, customer reviews, or news articles.
Infographic Design Infographic design involves creating visually engaging graphics that combine data, text, and images to convey information quickly and clearly.	**Energy Cost Simulation** Energy cost simulation involves the use of modelling and analytical techniques to predict and simulate the future costs of energy under various scenarios, including changes in demand, supply, and market conditions.
Time Series Animation Time series animation is a dynamic visualisation technique that shows how data points change over time, often in the form of an animated graph or map.	**Data-Driven Narratives** Data-driven narratives are automated or semi-automated stories generated from data, often using natural language generation (NLG) to create textual reports or summaries that explain key insights.
Multi-Dimensional Data Visualisations Multi-dimensional data visualisations are advanced visual techniques that represent data with multiple variables or dimensions, allowing users to explore complex relationships and patterns.	**Customisable Alerting and Notifications** Customisable alerting and notifications involve setting up automated systems that notify users when specific conditions or thresholds are met in the data, allowing for timely responses to emerging trends or issues.
Personalised Reporting (SRO (-)) Personalised reporting involves creating customised reports tailored to the specific needs and preferences of different stakeholders, often leveraging automated systems to deliver relevant insights on demand.	