Show and Tell
Dynamic, Data Driven Asset Rating (3DAR)

Scottish & Southern Electricity Networks

SIA

HOUSEKEEPING

- Today's session will be recorded

- Slides and the session recording will be made available over the course of the week
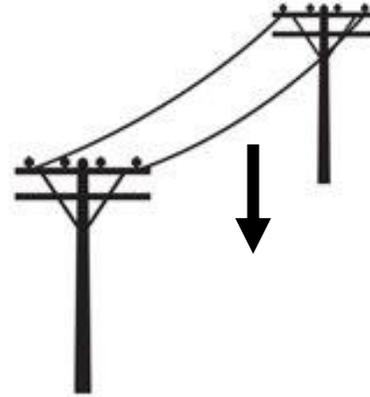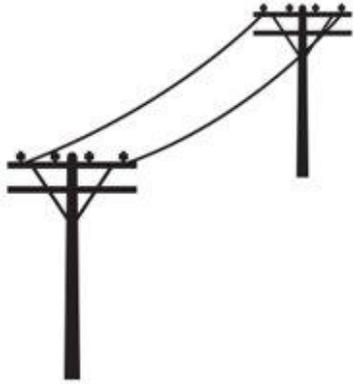

Video/webcams off   Mics on mute   Technical queries

- Please feel free to ask questions through the Q&A function – we'll cover as many as we can at the end of the presentation

Recap on Joule's First Law

A physical law expressing the relationship between the heat generated and the current flowing through a conductor.

- Conductors on a distribution or transmission line carry current – the capacity to which it can carry current is its ampacity.

- The thermal capacity of the conductor limits its ampacity

- The more electric current passing through the conductor the hotter it gets.

- This results in expansion and line sagging which can lead to safety issues.

- Weather also impacts this

Traditionally ampacity has been calculated using a STATIC rating based on a set of worst-case weather scenarios and applied twice per year

The true capacity of a conductor is not utilised because static ratings are used

Dynamic Asset Rating (DAR)

What is Dynamic Asset Rating (DAR)

- Approach to enable the immediate assessment of maximum current carrying capacity of a conductor
- Factors in temperature, wind, solar radiation etc.
- Adjusts capacity based on these factors to optimise network performance
- The dynamic asset rating is generally higher than the static rating

- Dynamic asset rating is not new
- Mainly used in Transmission, most methods rely on sensors on overhead lines to measure parameters
- Carrying out a survey for dynamic line rating is a long and expensive task and only used on a small set of conductors
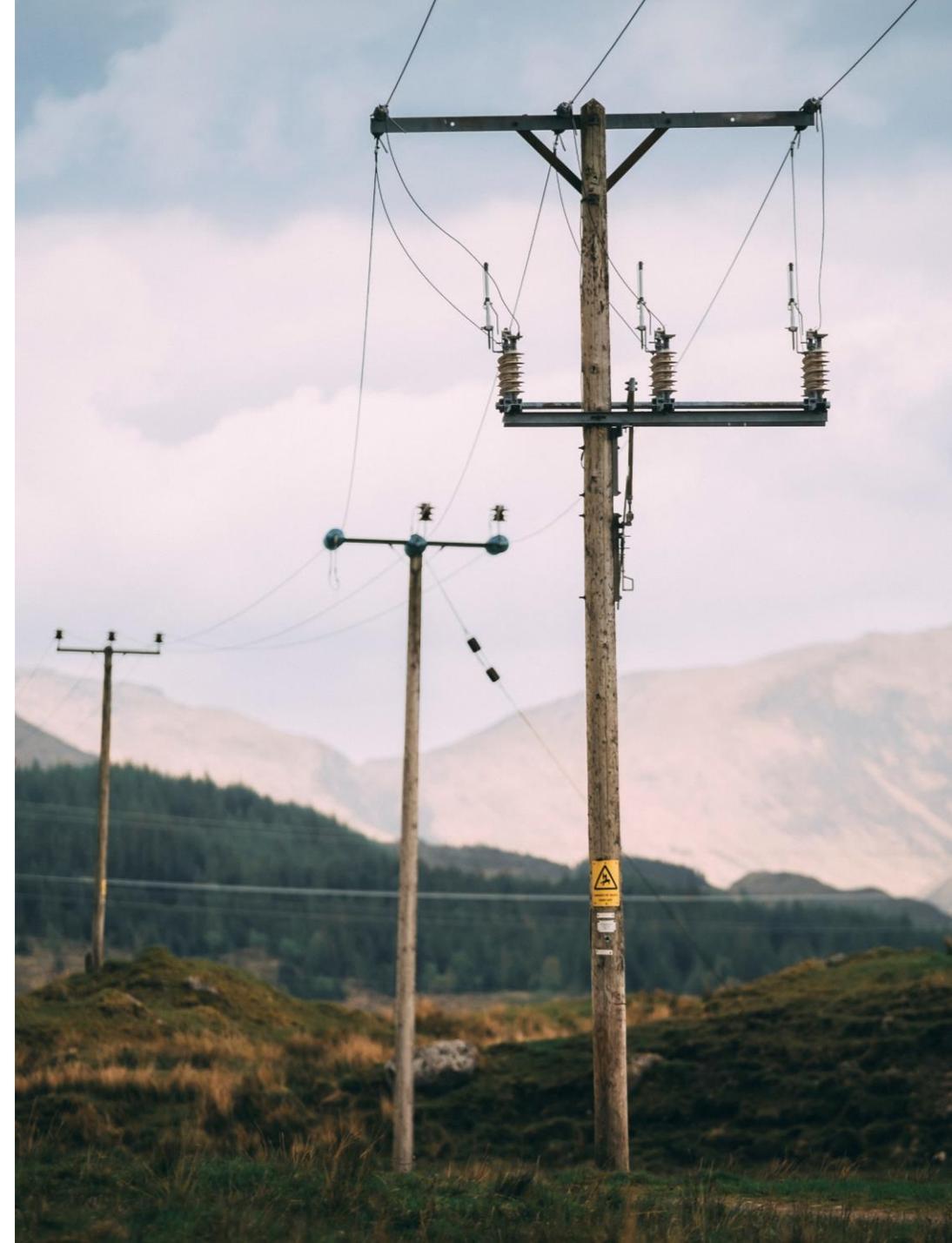
Background

Network and system planners currently have two main network intervention options to choose from to reduce constraint on assets, network reinforcement and flexibility. DAR offers another option which can be considered to increase capacity on the distribution network and tackle the below challenges.

**Increased Congestion**

Increased constraint & congestion from:
- intermittent renewable energy generators
- evolving end use of electricity
- increasing number of Distributed Energy Resources (DER) on the networks

Costly Traditional Interventions

Currently options are:
- reinforcing the network
- procuring flexibility services to meet these peaks.
- costly with long lead times.
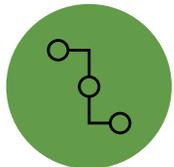
Lengthy process to establish DAR

The current process of establishing which asset could be appropriate for DAR is both time consuming lengthy and costly, which are key challenges 3DAR could address.

Challenges in renewable energy integration

Currently there is a delay in connecting DER, such as solar panels and small-scale turbines into the network due to curtailed generation.

Problem Statement and Challenge

'Dynamic, Data Driven Asset Rating' (3DAR) addresses *Challenge 1: Faster Network Development and focus area: Novel methods to increase electrical capacity from existing assets/ support more efficient connection methods.*
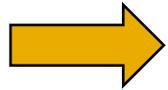
The 3DAR Discovery project looked at the feasibility of using 3DAR to cost-effectively assess the network and identify valuable assets for DAR deployment.

Identifying suitable assets for DAR is difficult and costly, 3DAR will speed up this process by using modelled weather and asset data to quickly identify those assets with potential additional capacity.
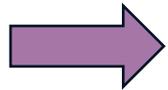
Initially focusing on overhead lines, 3DAR may expand to other assets based on suitability and potential.

If we do nothing, DAR installation on some constrained assets in SSEN's network will be gradual and costly. 3DAR aims to address this issue.

WP1

Requirements Gathering Asset Scoping (Literature Review)

WP2

Determining Optimal Use Cases for 3DAR (Methodology)

WP3

**Data requirements and enabling infrastructure (Cost Benefit Analysis)**

Key Insights

WP1 Overview: Sia delivered a literature review which reviewed existing studies and pilots on dynamic ratings on distribution-level assets to identify those most technically suitable for 3DAR. Sia benchmarked these findings on preferred assets against current processes for determining network reinforcement and flexibility needs.
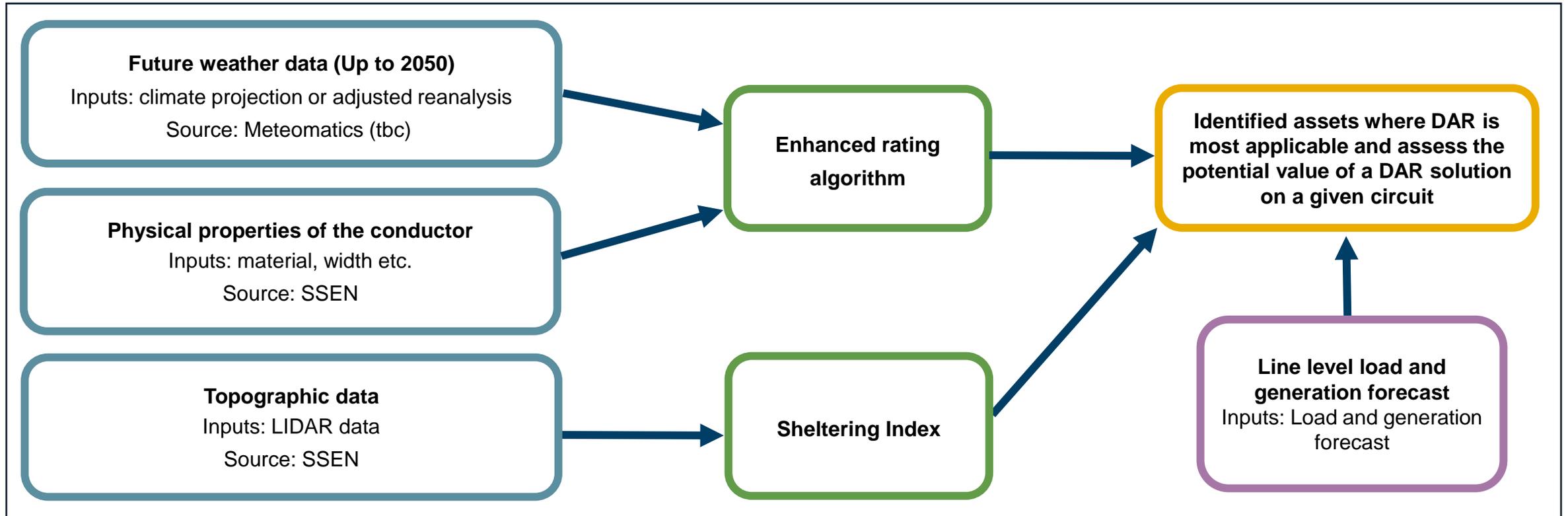
Topic	Key Insights	Highlights
Assets with Greatest Potential	• OHL's demonstrate the asset with greatest potential for value from DAR.	• Due to clear changes in ampacity with weather, OHL's have demonstrate assets with greatest potential on transmission networks.
DAR Use in Distribution	• Although there have been trials, few distribution networks have adopted DAR into their BAU network operation. • Much of literature on DAR at distribution level is based on simulations rather than actual trials.	• Key trials in the distribution networks such as FALCON (2015) has shown that DAR are often higher than SR. • Using multiple weather parameters beyond ambient temperature will mitigate challenges with forecasting future ampacity.
Existing Tools on Market	• Some DAR suppliers are currently working with distribution networks.	• Sensor-based increases capacity up to +40% for 50% of the time and +20% for 90% • Sensorless increases capacity by +15% for 50% of the time.
Network Planning Process	• The DAR forecast through 3DAR must precede the optioneering assessment to assess whether DAR is available to use before proposed as a network intervention lever	• Assessment of use cases of 3DAR has identified 3DAR benefits and DAR enabled benefits • CBA assessment demonstrated strong economic case £112m in NPV lifetime benefits, £105m of which are societal benefits driven by the accelerated connections

Proposed Methodology Overview

◆ Data　　◆ Calculations　　◆ Outputs
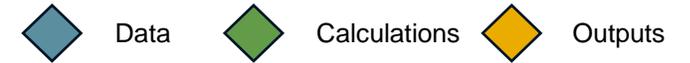
WP2 Overview: Outlines a methodology for assessing where DAR could impact SSEN's distribution network most by combining weather data, asset data and load analysis. It details potential data sources, optimisation strategies, and testing approaches to support future decision-making around DAR implementation

Future weather data (Up to 2050)
Inputs: climate projection or adjusted reanalysis
Source: Meteomatics (tbc)

Physical properties of the conductor
Inputs: material, width etc.
Source: SSEN

Topographic data
Inputs: LIDAR data
Source: SSEN

Enhanced rating algorithm

Sheltering Index

Identified assets where DAR is most applicable and assess the potential value of a DAR solution on a given circuit

Line level load and generation forecast
Inputs: Load and generation forecast

Implications for 3DAR: A draft methodology has been put forward that requires further refinement and testing in Alpha. In order to evaluate the feasibility and potential benefits of 3DAR we will establish a method to select circuits for testing the refined methodology. On these circuits we will calculate enhanced ratings and compare them with load constraints.

Learnings That Shape Alpha

The Discovery Phase has **proved the desire and support from a range of stakeholders for a solution to speed up the rollout across the network**, with the key use cases and their business cases defined. It has also highlighted some key elements that **need further work in future phases to develop into a viable BAU service.**

Key Lessons Learnt

3DAR proposed as a network intervention lever alongside flex procurement and reinforcement recommendations in the DNOA.

Methodology can assess how much terrain shelters a line segment from certain weather conditions & a forecast of enhanced ratings based on long-term weather estimates.

A testing approach has been defined in Alpha across defined circuits.

Plans for Alpha phase

Define DNOA process, where 3DAR would fit, identify the systems and technical requirements, and inputs & outputs

Refine 3DAR methodology to confirm enhanced rating algorithm, clarify resolution and availability of load data & select weather data source

SSEN to identify which circuits would be most critical to test on

WHAT'S NEXT?

DNOA Current and Future Process Identification

- Understand how 3DAR tangibly fits in the DNOA process
- Understand all the use cases and functionalities required for 3DAR for DNOA team to use the system
- Understand scope for application to other assets

Prototype Building and Data Collection

- Define method to select circuits to test on
- Refine and test methodology on selected circuits for enhanced ratings
- Establish scoring methodology
- Validation of methodology with DAR provider

3DAR Solution Design

- Articulate the technical design requirements for 3DAR and associated infrastructure
- Identify what the product could look like.

Commercial Justification for 3DAR

- Engagement with other DNOs on applicability of methodology
- Engagement with network modelling and reporting team to remodel CBA for an updated valuation estimate of 3DAR
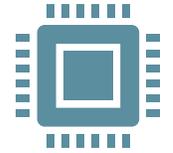
Summary

Currently DAR is restricted to a small number of assets due to cost

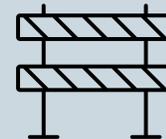**We need to develop a way to rate an asset without the need for sensors and field surveys**
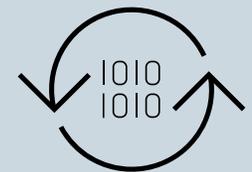
What will 3DAR do?

Digitise the assessment of asset rating to allow DAR to be scaled and ubiquitous

Allow DAR to become network intervention lever alongside reinforcement and flex

Remove barriers to assessment and selection of assets for DAR

Allow assessment of the whole network, with 3DAR being applied regularly so options are not missed

QUESTIONS

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