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Frequency Risk and Control Report

April 2021 edition

Methodology consultation webinar

Agenda

We'll cover the following topics

- Summary of GSR027 changes
- Aims
- Structure
- Industry consultation questions
- Policy
- Methodology
- How to respond
- Q&A

Summary of GSR027 changes

Summary of GSR027 changes

SQSS modification GSR027 developed to address Ofgem/E3C actions

Key changes:

- Updating the operational chapters and the definition of ‘Unacceptable Frequency Conditions’ to reference the Frequency Risk and Control Report (FRCR)
- The FRCR will set out the contingencies that the ESO will cover operationally
- Clarify that consequential losses of distributed energy resources associated with any event will be included in FRCR considerations
- Provide standing to the FRCR and the FRCR methodology that will be used to produce this

Aims

This edition of the FRCR has three key aims

- establish a clear, objective, transparent process for assessing reliability vs. cost of operating the National Electricity Transmission System with respect to frequency, to ensure the best outcome for consumers

- make the assessment of the risk from the inadvertent operation of Loss of Mains protection transparent

- identify quick, short-term improvements for reliability vs. cost

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Structure

Structure

Structure

Policy

Methodology

Report

- states current National Grid Electricity System Operator (NGESO) policy for frequency risks and controls, and
- provides a baseline for the first edition of the Frequency Risk and Control Report

It is written with the intention of providing clarity and transparency to the way NGESO operates the system with respect to frequency control.

It is also a necessary start-point for the process of developing the first edition of the Frequency Risk and Control Report.

Readers should familiarise themselves with the Policy document before proceeding to read the Methodology.

Structure

Policy

Methodology

Report

builds upon the Policy document, and lays out:

- what will be assessed in the April 2021 edition of the Report
- how it will be assessed, and
- the format of the outputs

Structure

Policy

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Methodology

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Report

Sets out the results of the assessment of the operational frequency risks on the system, and will be prepared in accordance with the Methodology.

It will include an assessment of the magnitude, duration and likelihood of transient frequency deviations, forecast impact and the cost of securing the system and confirm which risks will or will not be secured operationally by NGESO in accordance with paragraphs 5.8, 5.11.2, 9.2 and 9.4.2 of the SQSS.

The target date for the Report to be submitted to the Authority for approval is 01 April 2021.

Structure

Transparency around current operation, and baseline for methodology

The subject of this consultation

Next step in the process, subject of a future consultation

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Consultation

Timeline

Milestone	Date
Methodology consultation	21 Dec – 13 Jan 2021
SQSS Panel meeting – decision on recommendation of methodology for use in preparing FRCR	29 Jan 2021
FRCR consultation	Feb – Mar 2021
SQSS Panel meeting – decision on recommendation of FRCR	Mar 2021
Submission of FRCR to Ofgem	1 Apr 2021

★ we are here

Industry consultation questions

1. Overall, do you agree that this methodology will allow the preparation of an appropriate FRCR? (as required by modification GSR027)

2. To help structure comments, do you have any particular feedback on (each section) of the methodology?

3. How well will this methodology address its three key aims?
   a. establish a clear, objective, transparent process for assessing reliability vs. cost to ensure the best outcome for consumers
   b. make the assessment of the risk from the inadvertent operation of Loss of Mains protection transparent
   c. identify quick, short-term improvements for reliability vs. cost

4. Do you have any further comments?

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Policy

Policy

- Impact of frequency deviations
- Events and loss risks
- Controls
- Cost vs. Risk
- General Policy
- Specific Policy
- Appendices

- Impact of frequency deviations
- Events and loss risks
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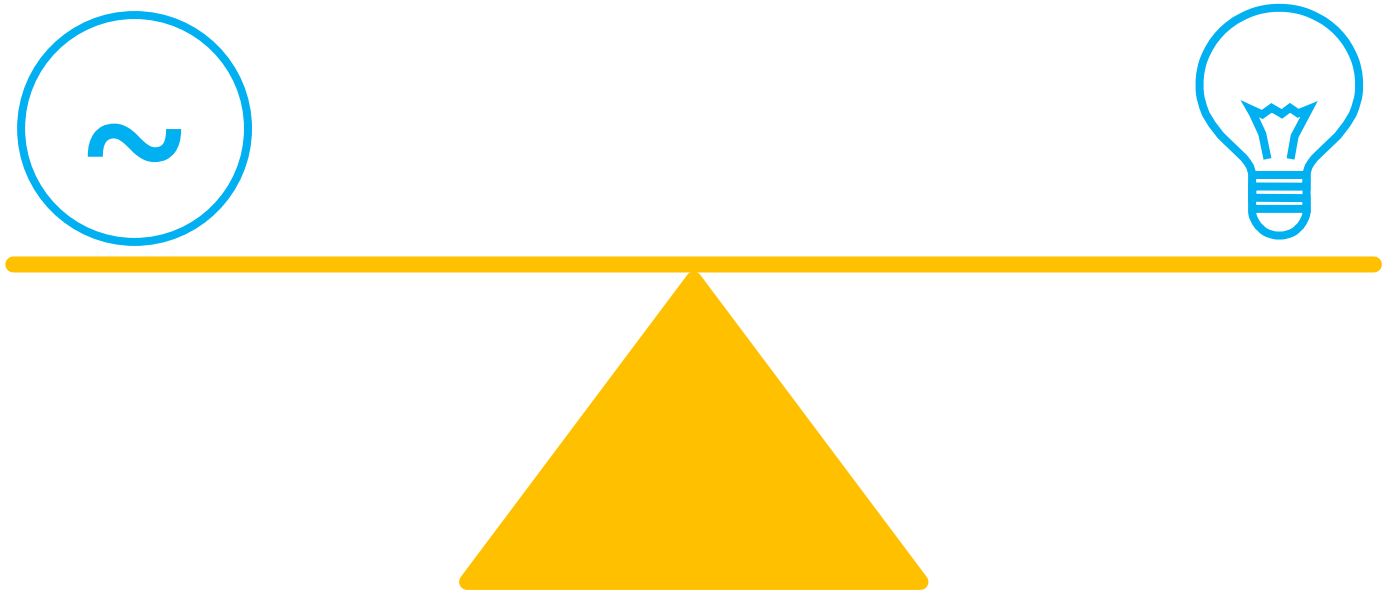

Generation = Demand

Frequency = steady

- Impact of frequency deviations
- Events and loss risks
- Controls
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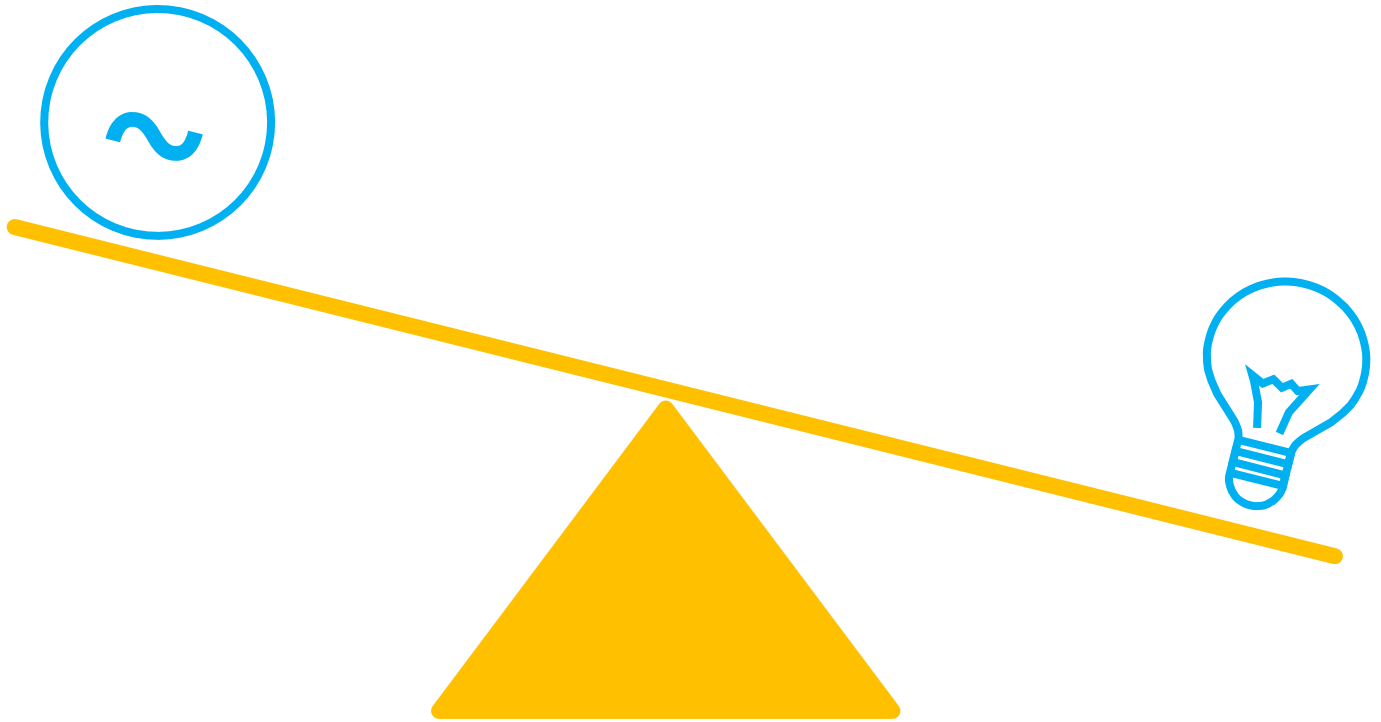

Generation < Demand

Frequency = fall

- Impact of frequency deviations
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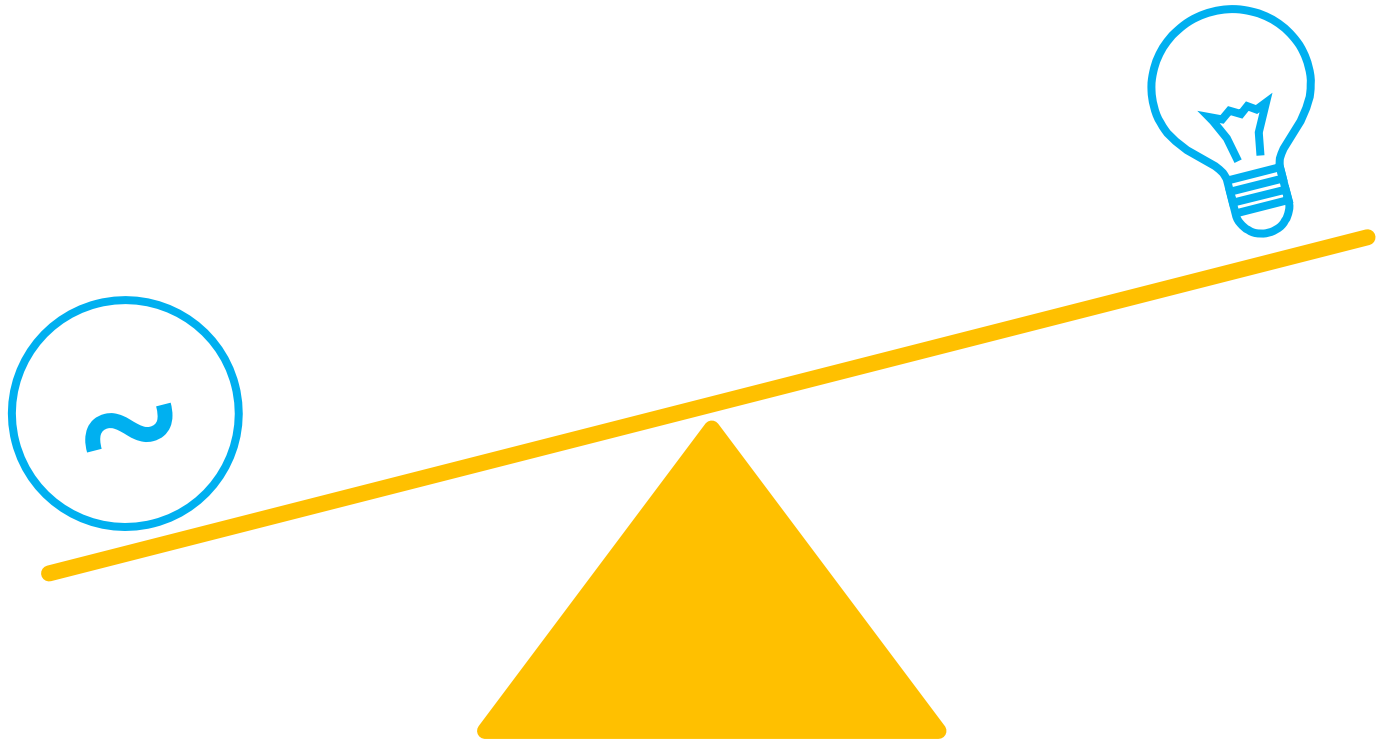

Generation > Demand

Frequency = rise

- Impact of frequency deviations
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What causes frequency deviations?

- Transient frequency deviations outside of steady state frequency limits only occur if a sufficiently large generation or large demand loss happens over very short timescales

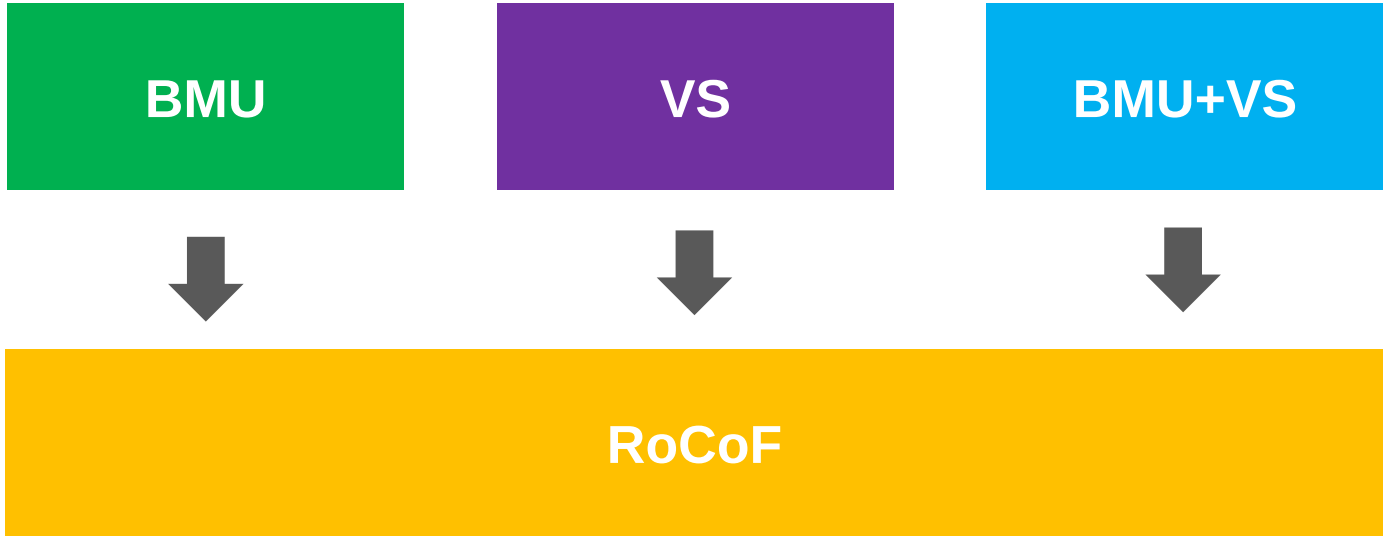
Considerations

- The impact of a transient frequency deviation depends on its duration, size and the conditions under which it occurs

Frequency limits

- NGESO applies a number of frequency limits to minimise the likelihood of unacceptable frequency conditions

- Policy covers the following six categories of loss risks
- These includes events on the transmission system which cause the consequential loss of Distributed Energy Resources through:
  - Rate of Change of Frequency (RoCoF) and
  - Vector Shift (VS)



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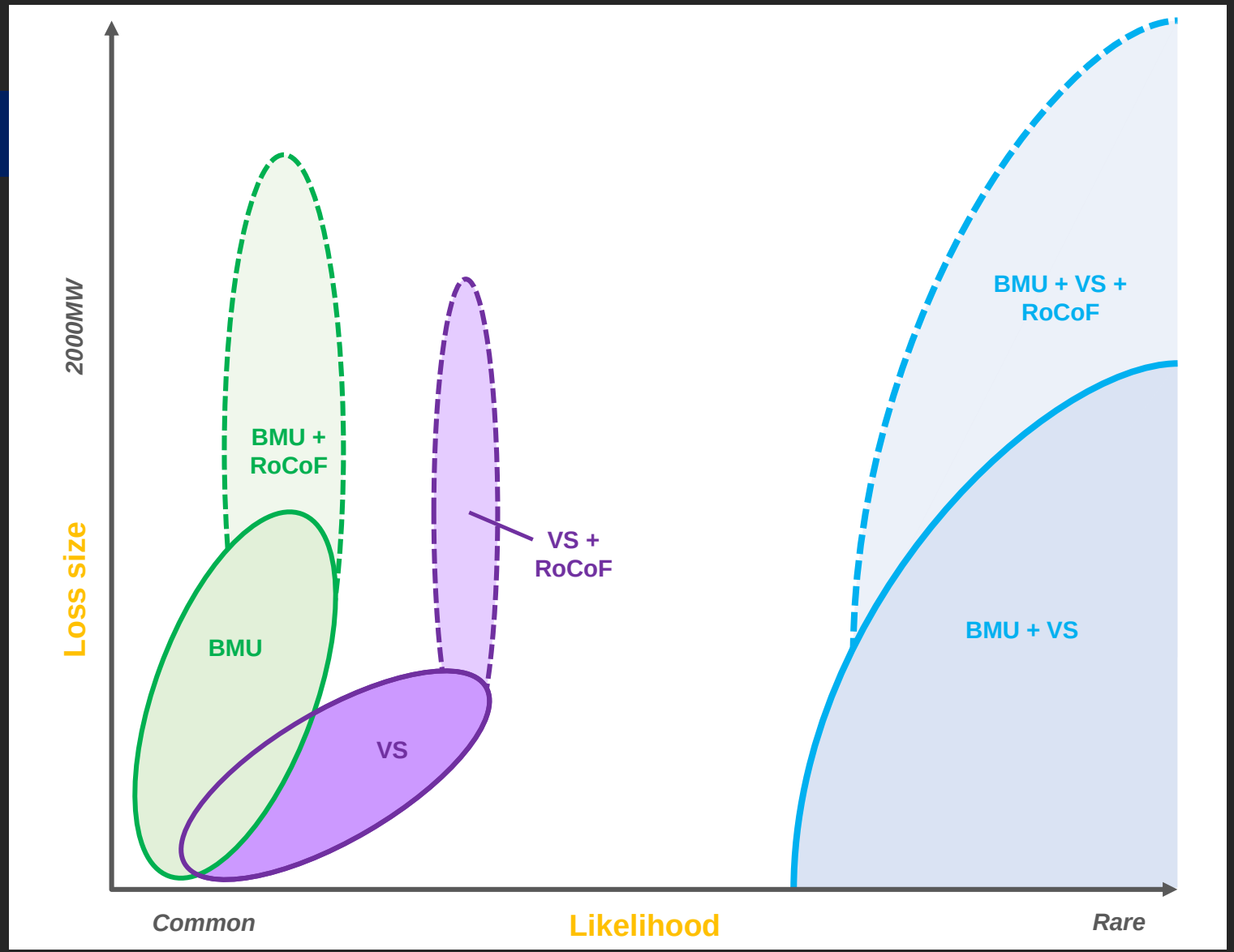
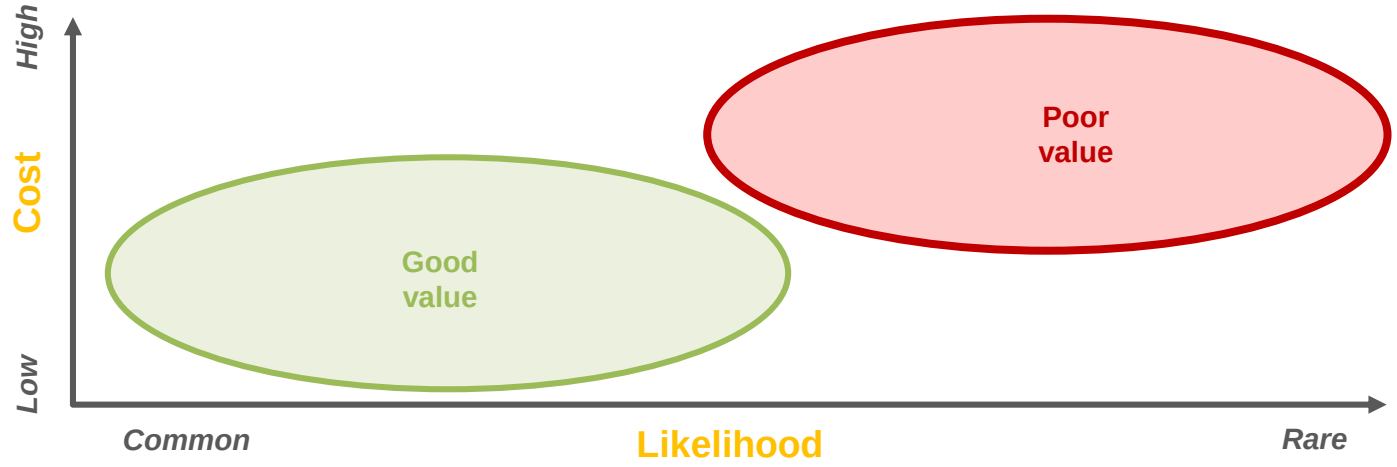


- There are four main controls for mitigating transient frequency deviations:
  - holding frequency response
  - reducing BMU loss size
  - reducing Loss of Mains (LoM) loss size
  - increasing inertia

- As a general principle:
  - good-value risks are likely to be those which are lower cost to mitigate or contain, have a high likelihood, or which have a large impact
  - poor-value risks are likely to be those which are higher cost to mitigate or contain, have a low likelihood, or which have a small impact
- There is a whole spectrum of costs and likelihoods across each of the events.



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	BMU-only	VS-only	BMU + RoCoF	VS + RoCoF	BMU + VS	BMU + VS + RoCoF
Considered by policy	Yes	Yes	Yes	Yes	Yes	Yes
Mitigated in real-time	Yes	Yes	Yes	Yes	No	No
Main control	Frequency response	Frequency response	Reduce BMU loss size	Inertia	Reduce LoM loss size	Reduce LoM loss size
Additional control	Inertia or Reduce BMU loss size	n/a	Inertia	n/a	n/a	n/a

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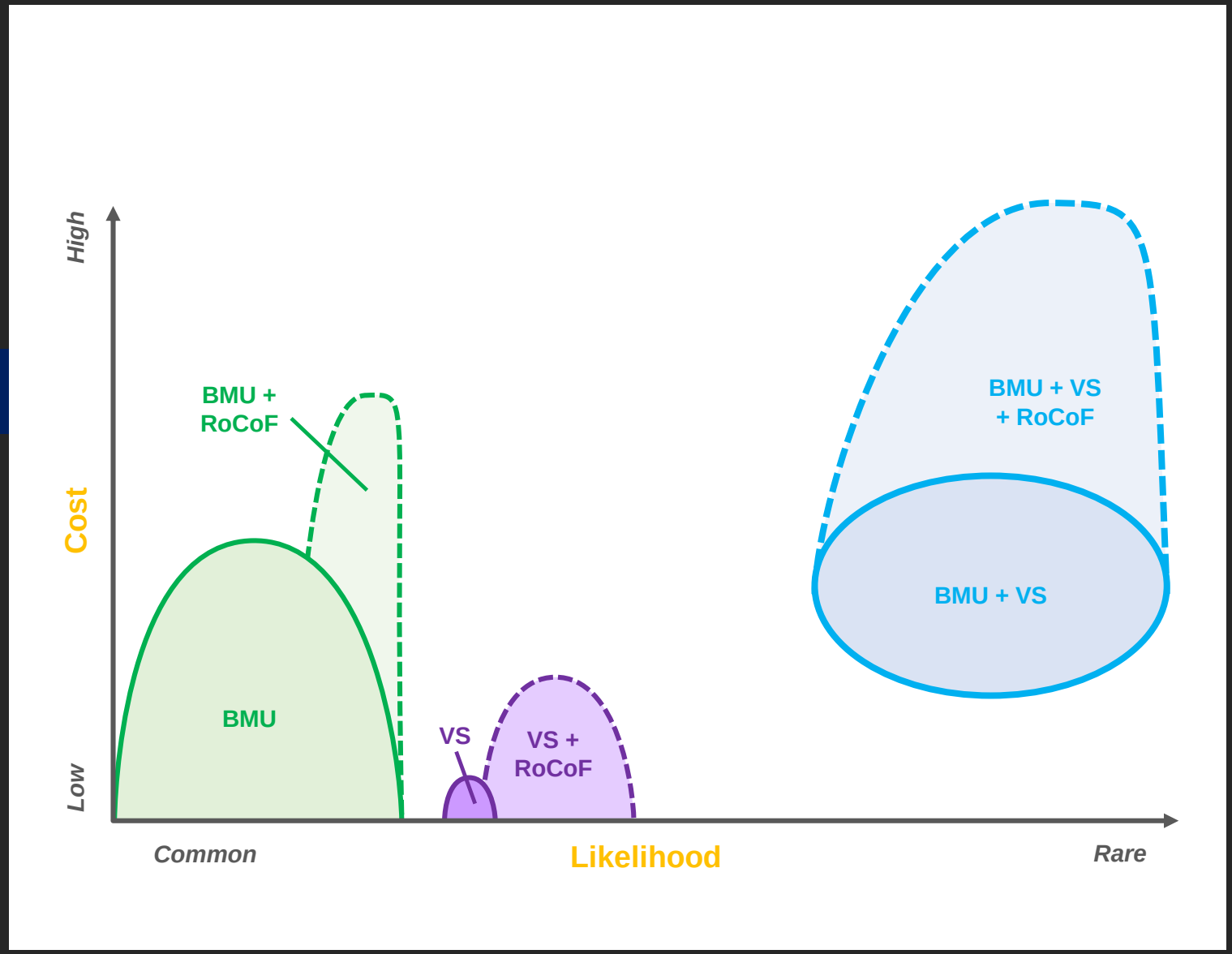

- Details how the ESO apply the four main controls for mitigating transient frequency deviations:
  - holding frequency response
  - reducing BMU loss size
  - reducing Loss of Mains (LoM) loss size
  - increasing inertia
- There are specific, limited variations to these policies based on technical, probabilistic and economic grounds. This includes additional actions where appropriate during times of increased system risk, such as during severe weather, and exceptions where risks cannot feasibly occur

Methodology

Methodology

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3. How well will this methodology address its three key aims?
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4. Do you have any further comments?

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- The impact of a transient frequency deviation can be assessed by the combination of three metrics:
  - size ⇒ how far they deviate
  - duration ⇒ how long they persist for
  - Interval ⇒ how infrequently they occur

- We will assess four levels of impact, which align to current frequency response holding policies, but provide more detail for the likelihood of triggering Low Frequency Demand Disconnection

#	Deviation	Duration	Relevance
H1	50.5 < Hz	Any	• Above current SQSS implementation • Plant performance less certain
L1	49.2 ≤ Hz < 49.5	60 seconds	• Current SQSS and SOGL implementation • Infrequent occurrence, but reasonable certainty over plant performance
L2	48.8 < Hz < 49.2	Any	• Beyond current SQSS implementation and SOGL, but without triggering LFDD • Plant performance less certain
L3	47.75 < Hz ≤ 48.8	Any	• First stage of LFDD

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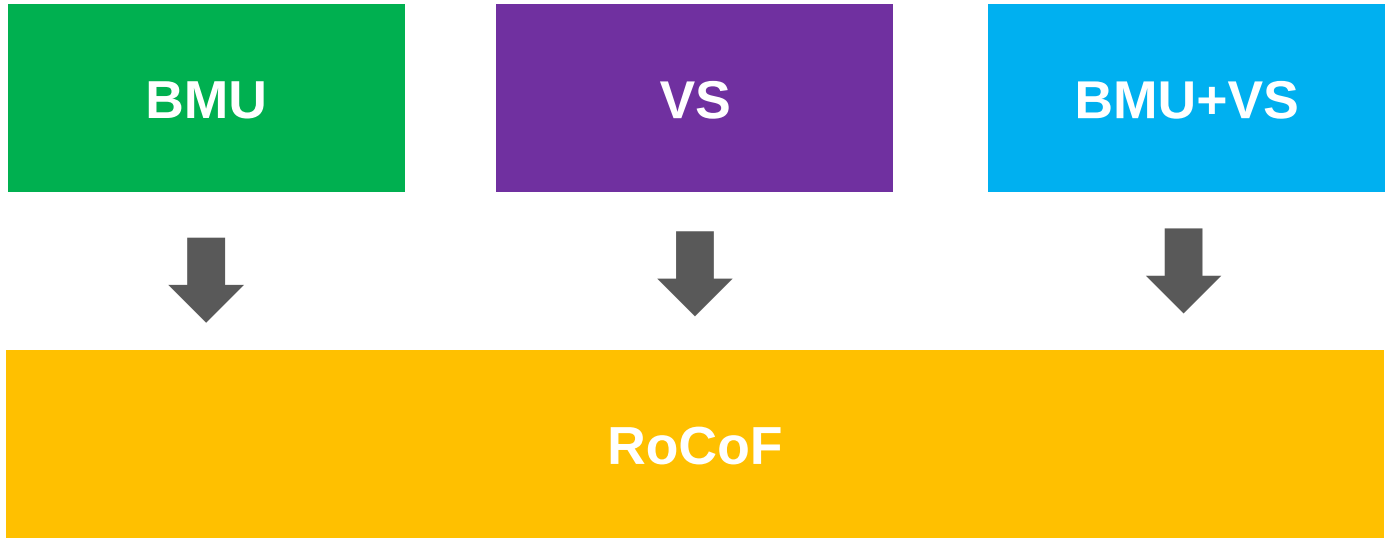
We will assess:

- the six categories of loss risks covered by current Policy



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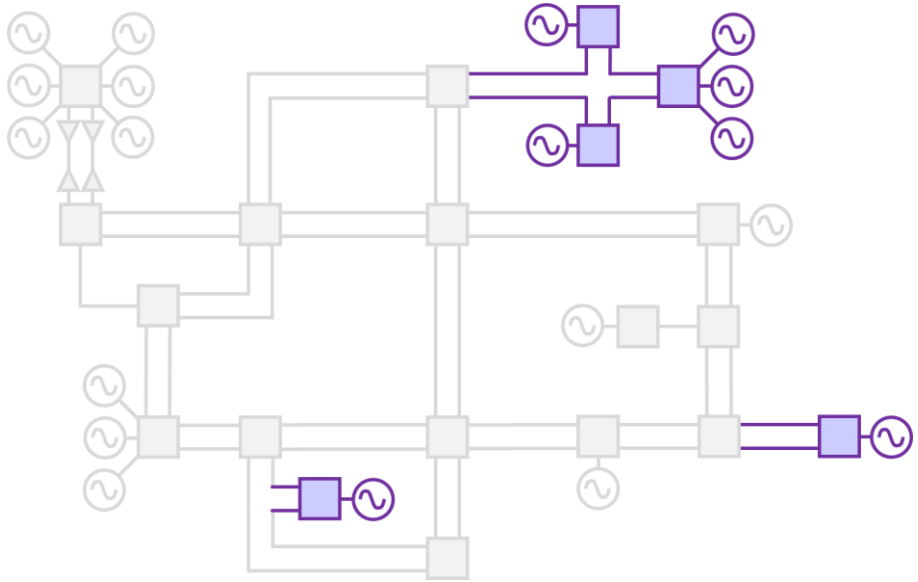
We will assess:

- the six categories of loss risks covered by current Policy

  and

- the impact of transmission network outages on radial connection loss risks



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- We will investigate variations to current Policy for:
  - holding frequency response
    - Dynamic Containment
    - frequency limit for different size loss risks
  - reducing LoM loss size
- The other controls will be applied in the same way as current Policy

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What principles can be applied?

- At its simplest, for each level of impact:
  - good value risks are likely to be those which are:
    - low cost to mitigate,
    - likely to occur, or
    - which have a large impact
  - poor value risks are likely to be those which are:
    - high cost to mitigate,
    - unlikely to occur, or
    - which have a small impact

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What metrics can be applied?

- When deciding on the balance between reliability and cost, there are several metrics the industry and Authority may wish to consider.

  Some example metrics are outlined below. Once the industry has decided on these metrics, they can be overlaid on the results of the analysis to inform the recommendation.

- Example metrics
  - How often each impact is expected to occur
  - Cost value per avoided occurrence
  - Total cost per year

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Historic vs. forecast

- the analysis will use historic scenarios adjusted for known or expected changes in the coming 12 months

Granularity and time period

- the analysis will be performed as a time series (at Settlement Period granularity) for the 2019 and 2020 calendar years

Baseline system conditions

- we will unwind balancing actions from the historic data sets to get a representation of the “market position” for these baseline system conditions

Cost of mitigations

- will be benchmarked against the typical prices for each control

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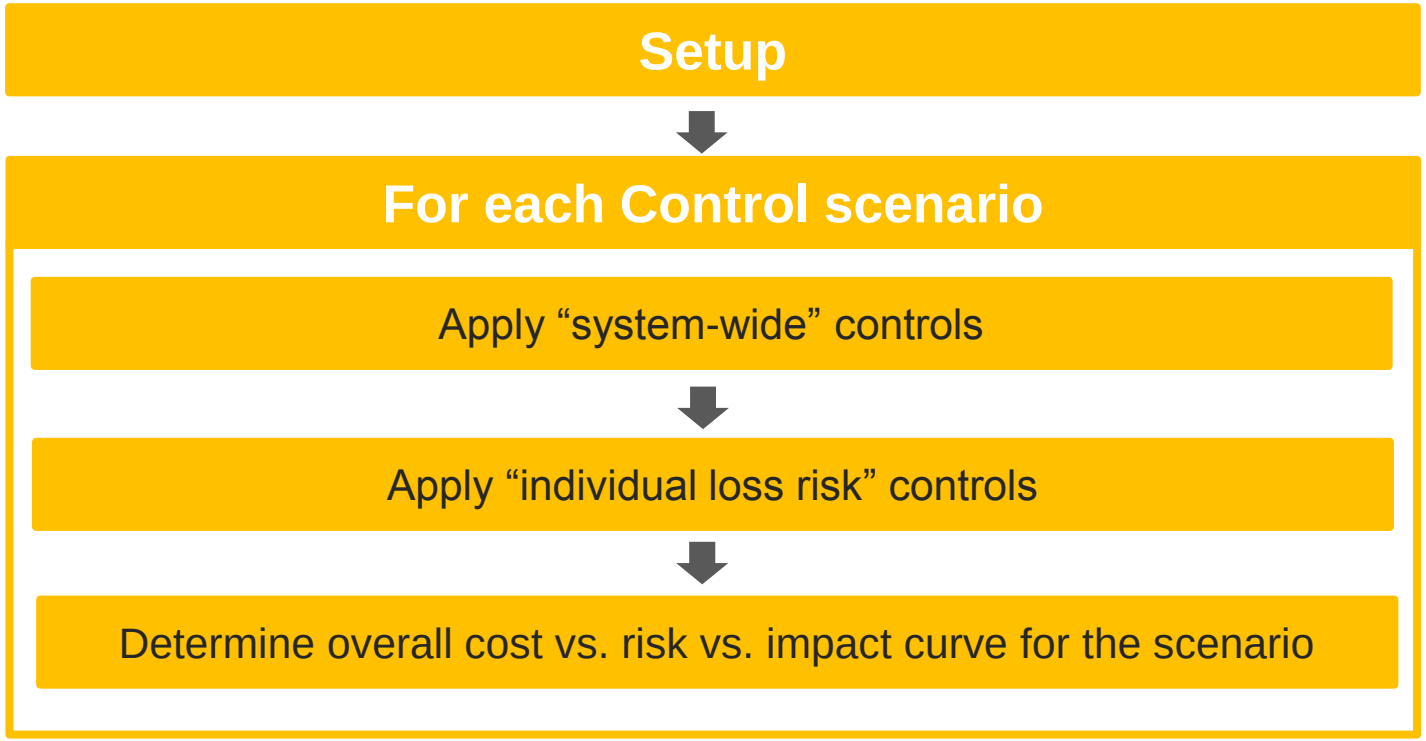

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Setup

Starting with current Policy as a baseline:

- Define Control scenarios
- Define Events and loss risks

For each Control scenario

Apply “system-wide” controls

Apply “individual loss risk” controls

Determine overall cost vs. risk vs. impact curve for the scenario

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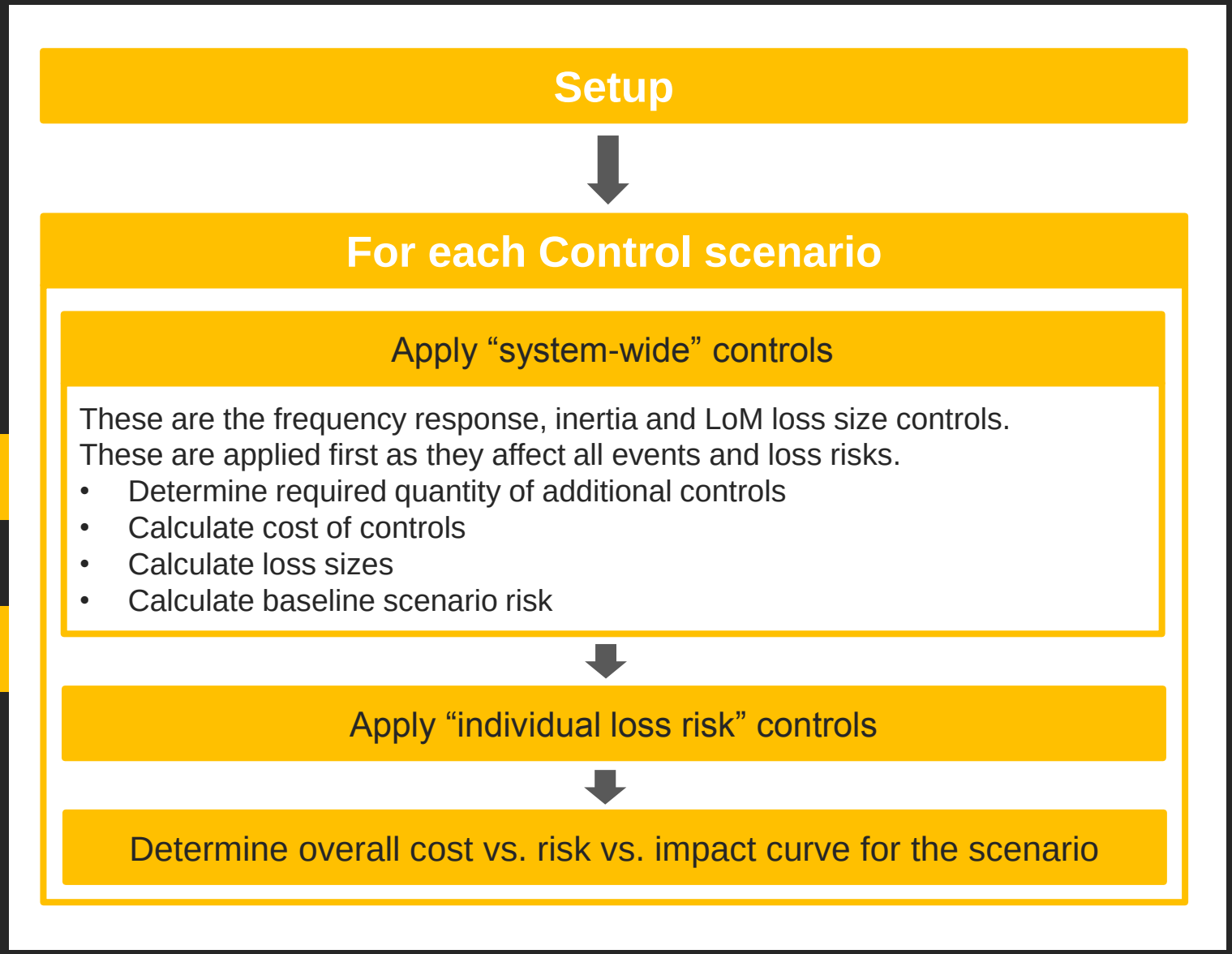

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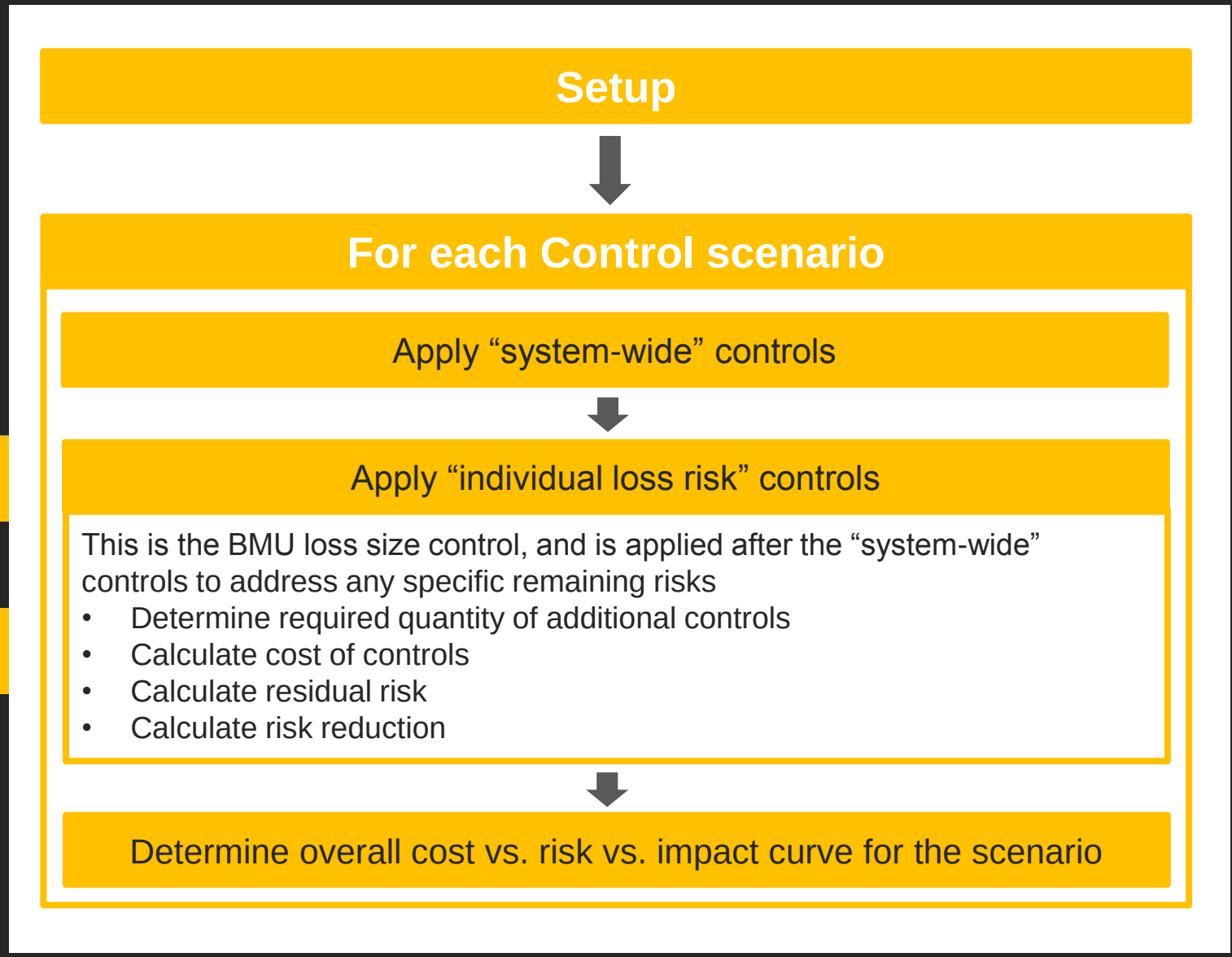

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For each Control scenario

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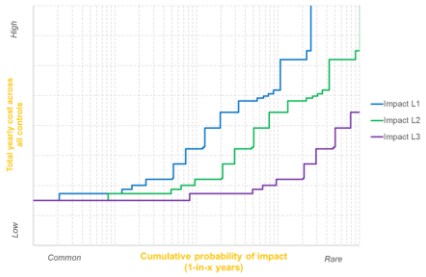

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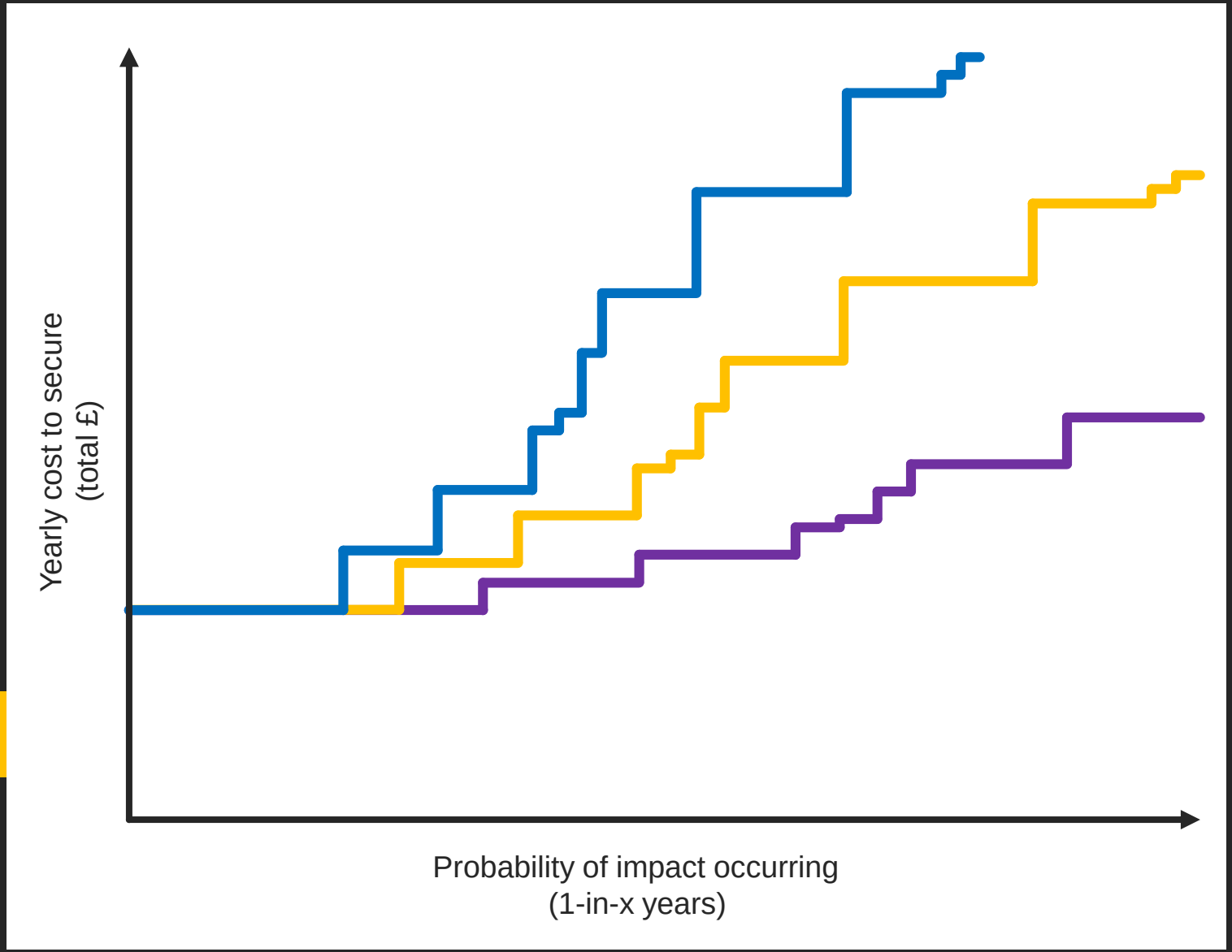
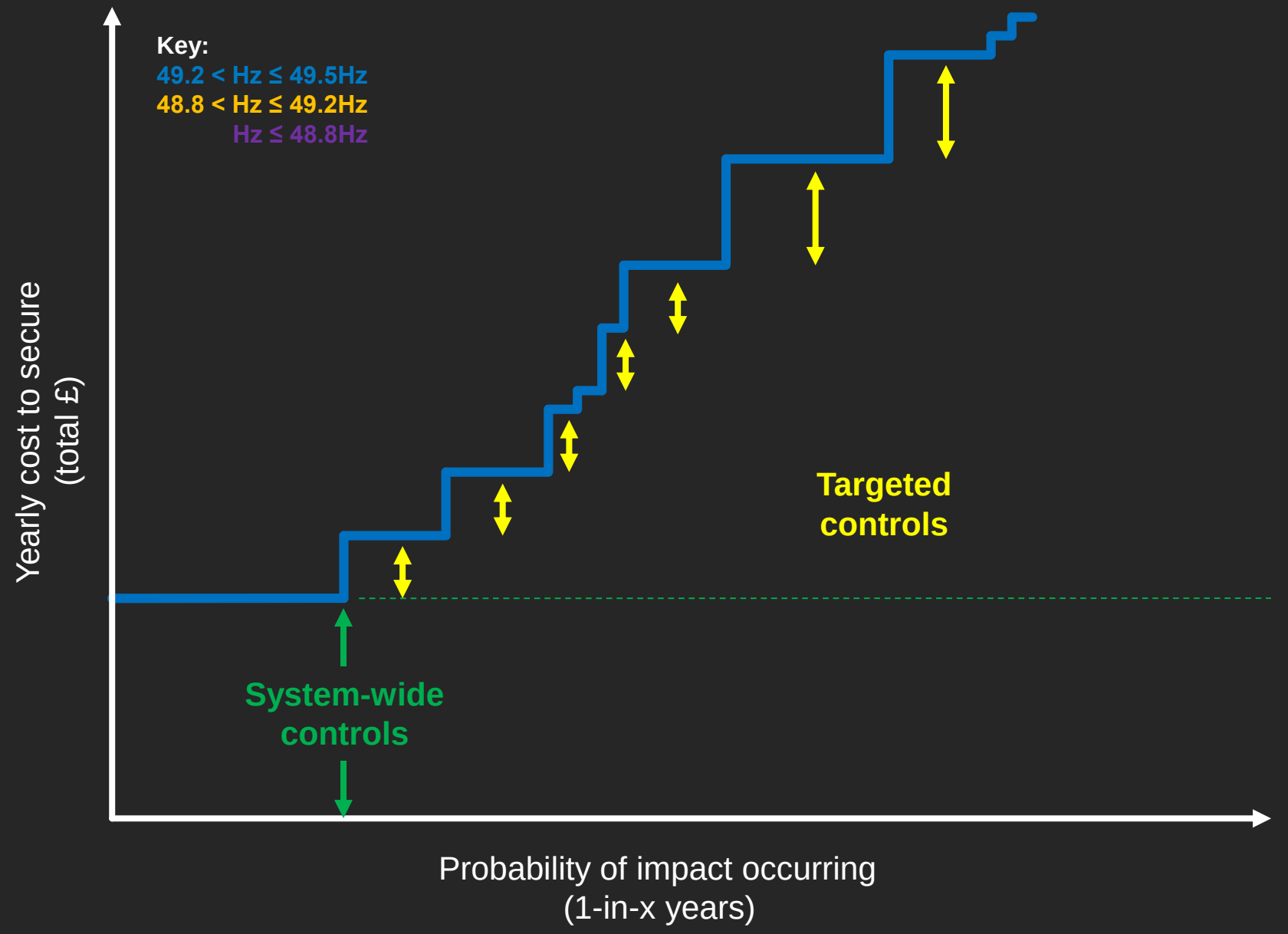


Reliability vs. cost



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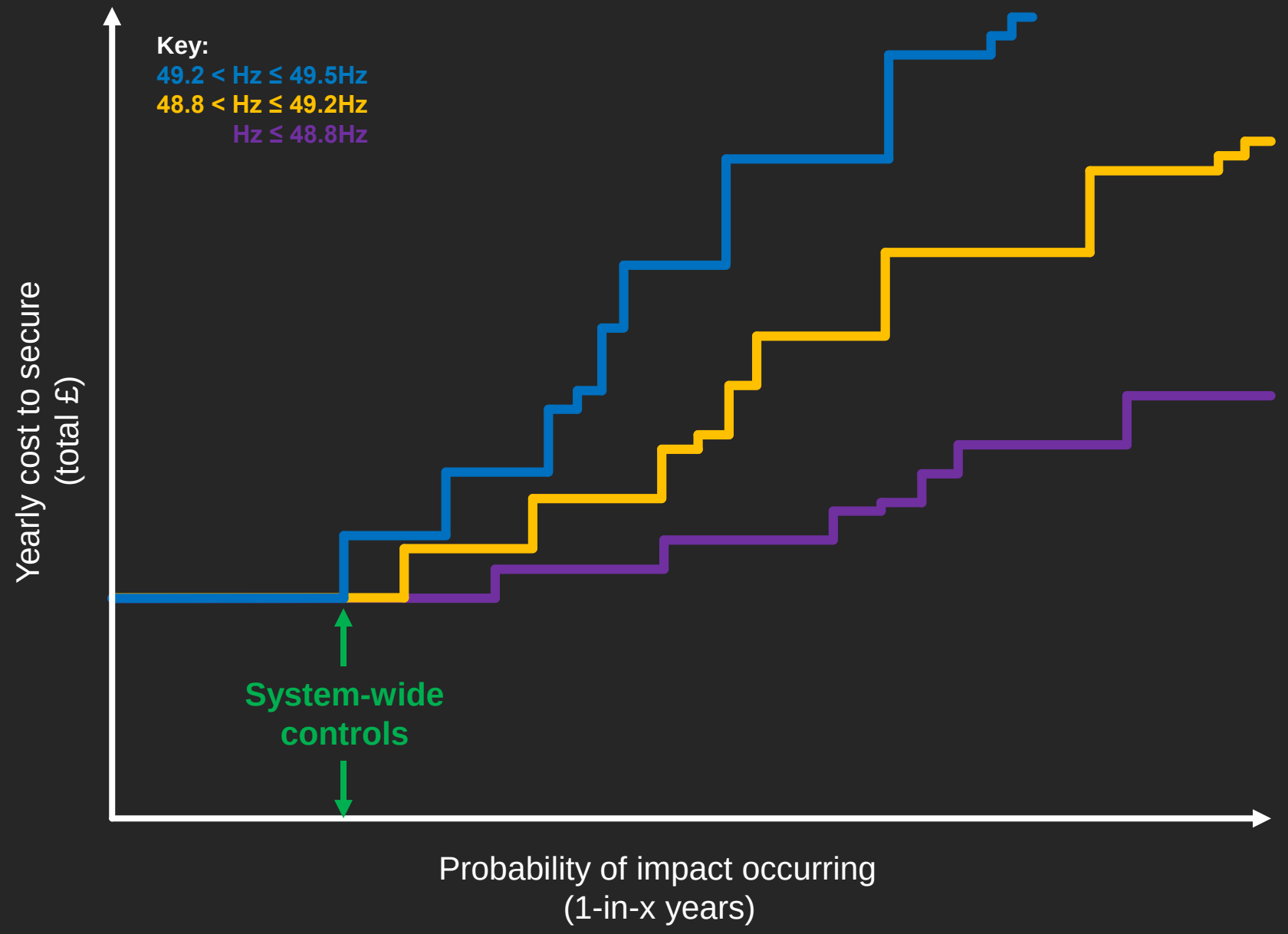

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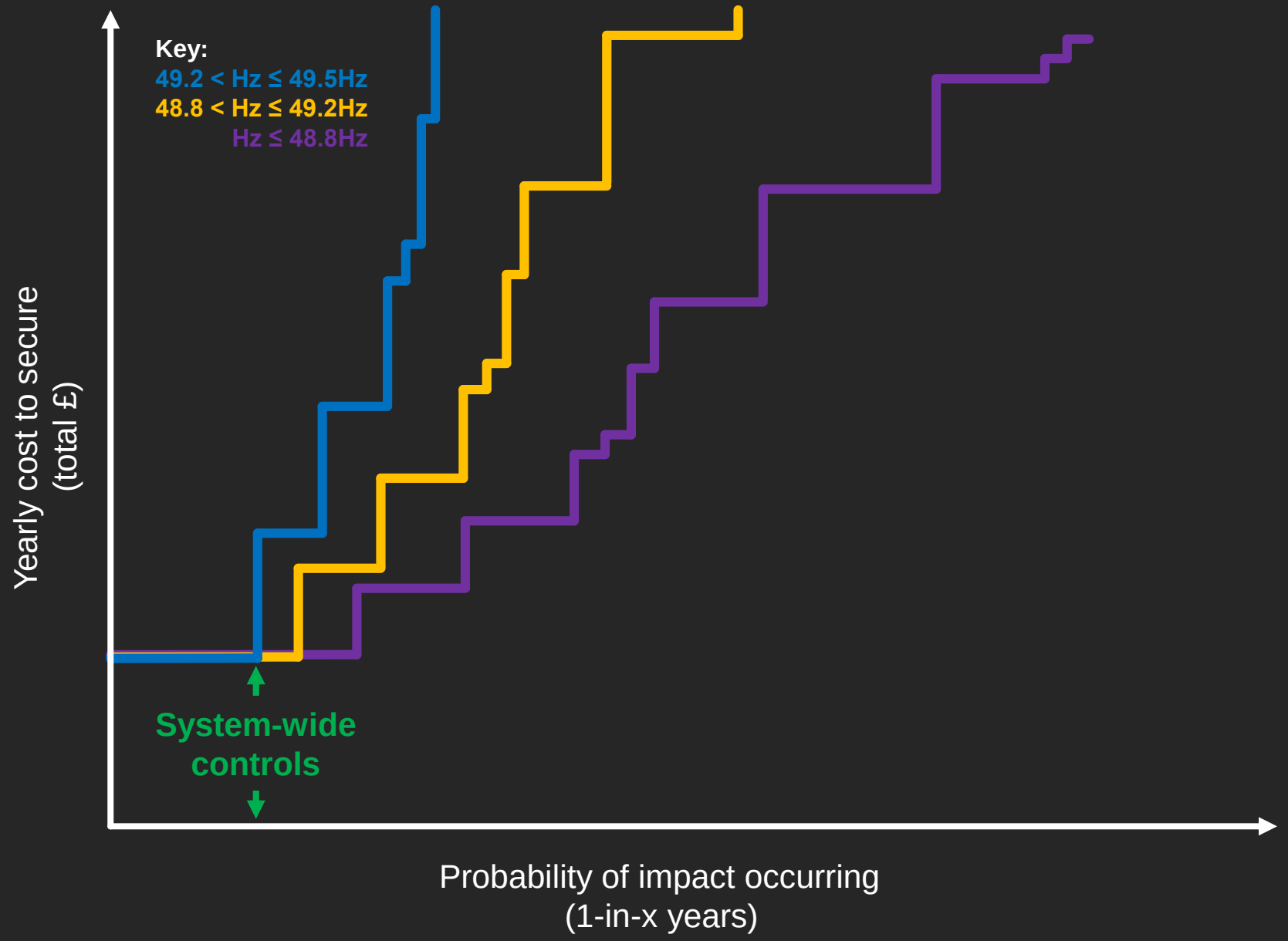

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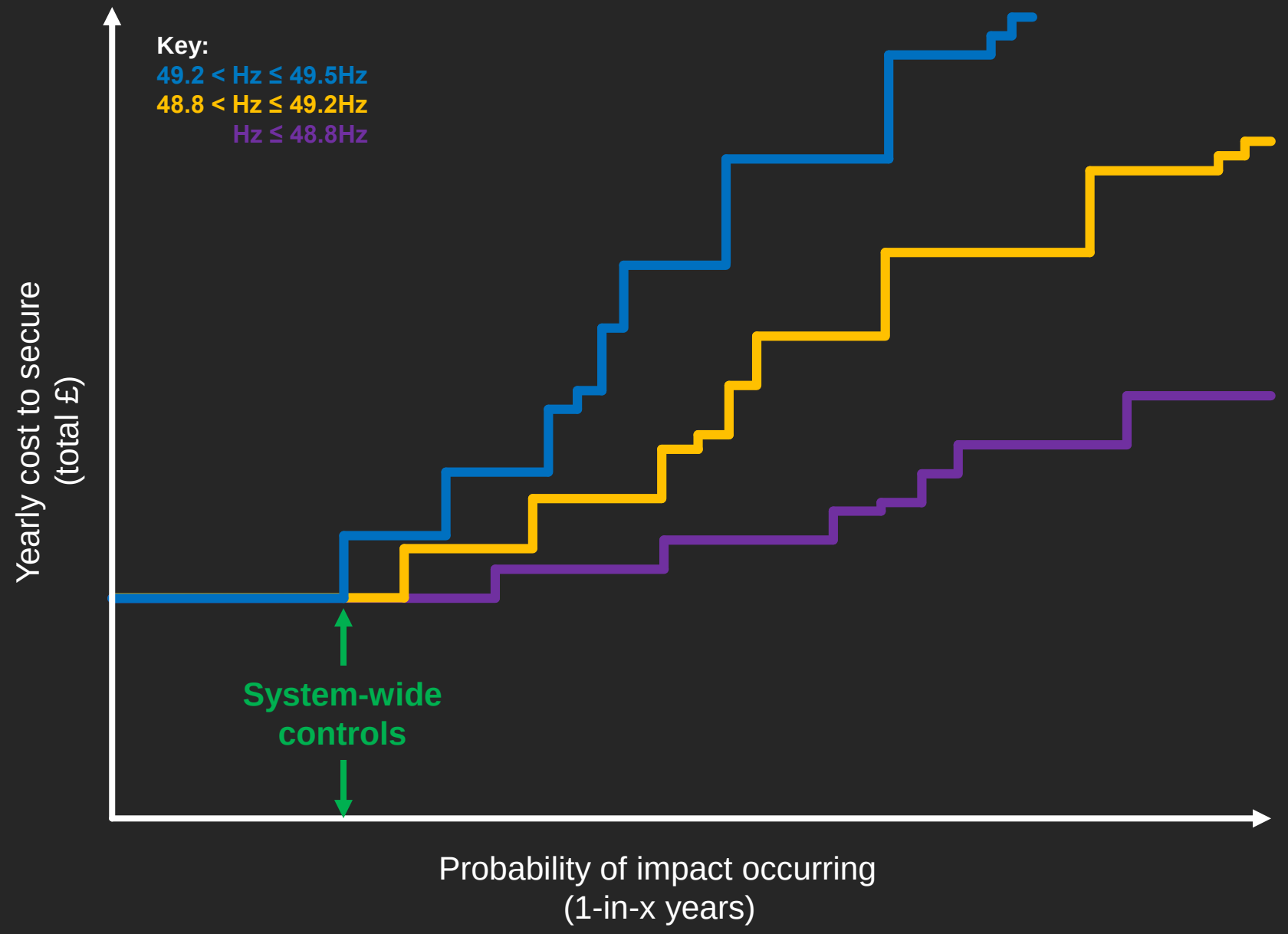

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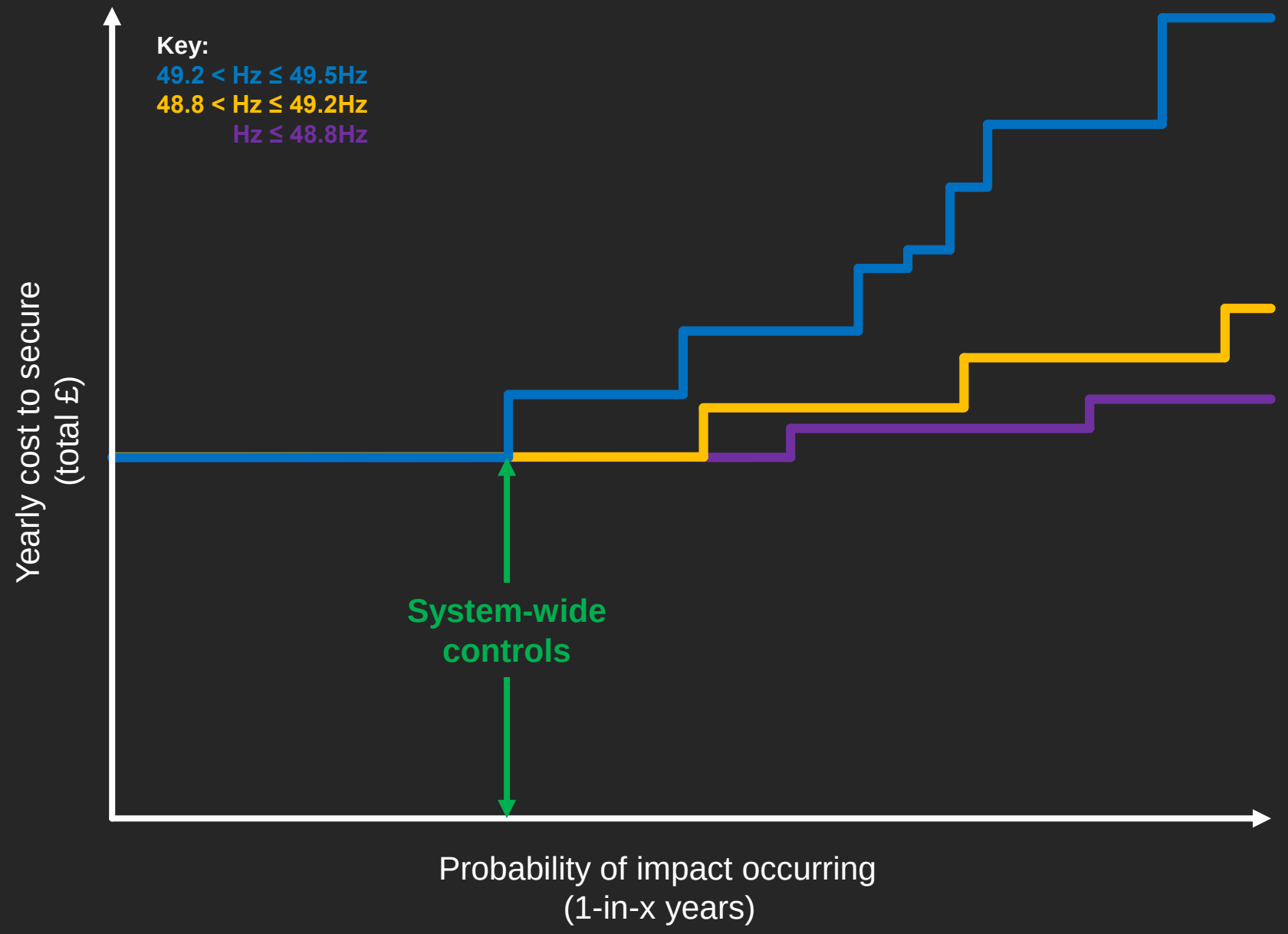

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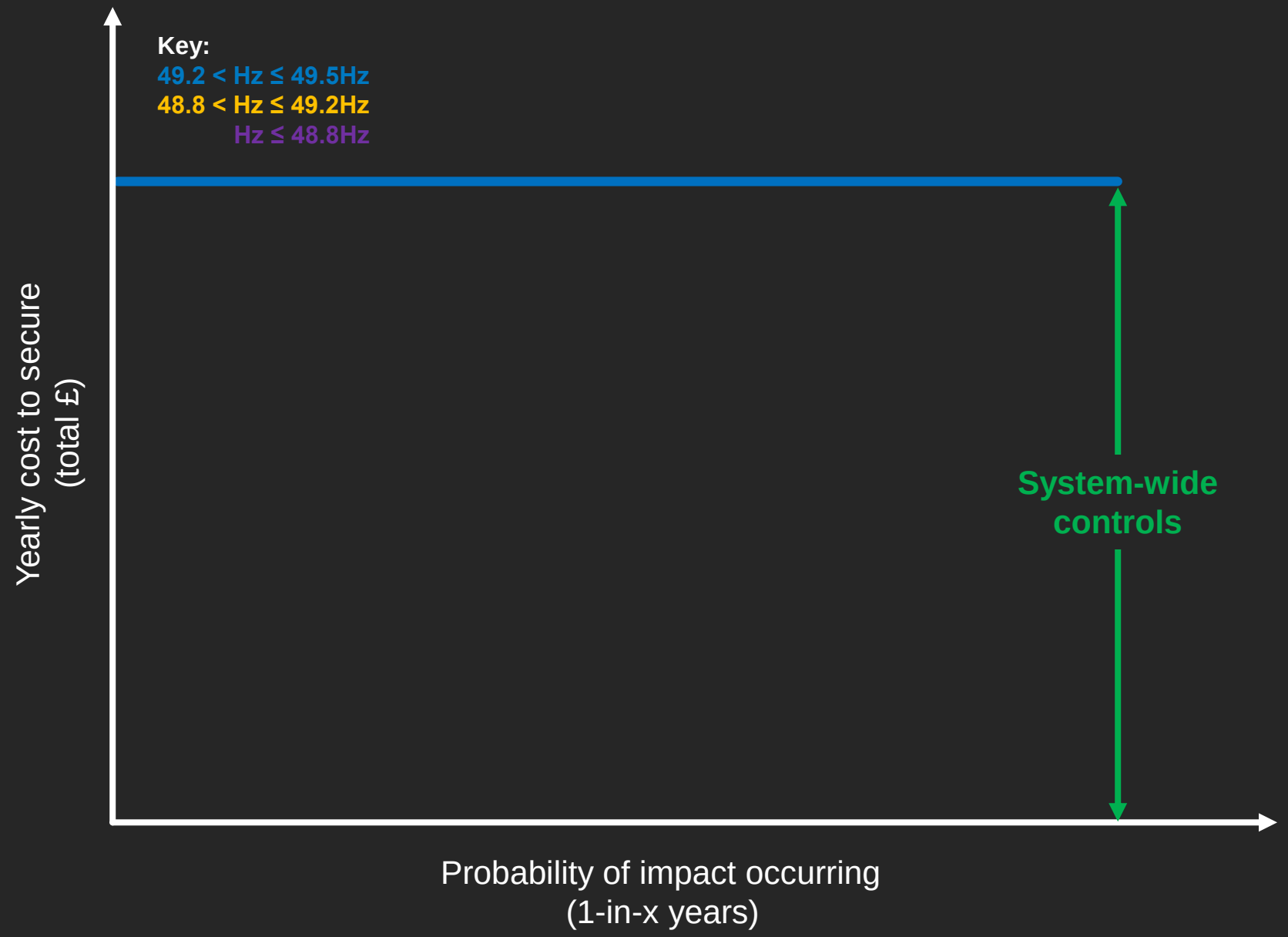

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Main recommendations

An overall recommendation can then be made, on which set of controls represents the best balance between reliability and cost for the coming Report period, typically the coming year.

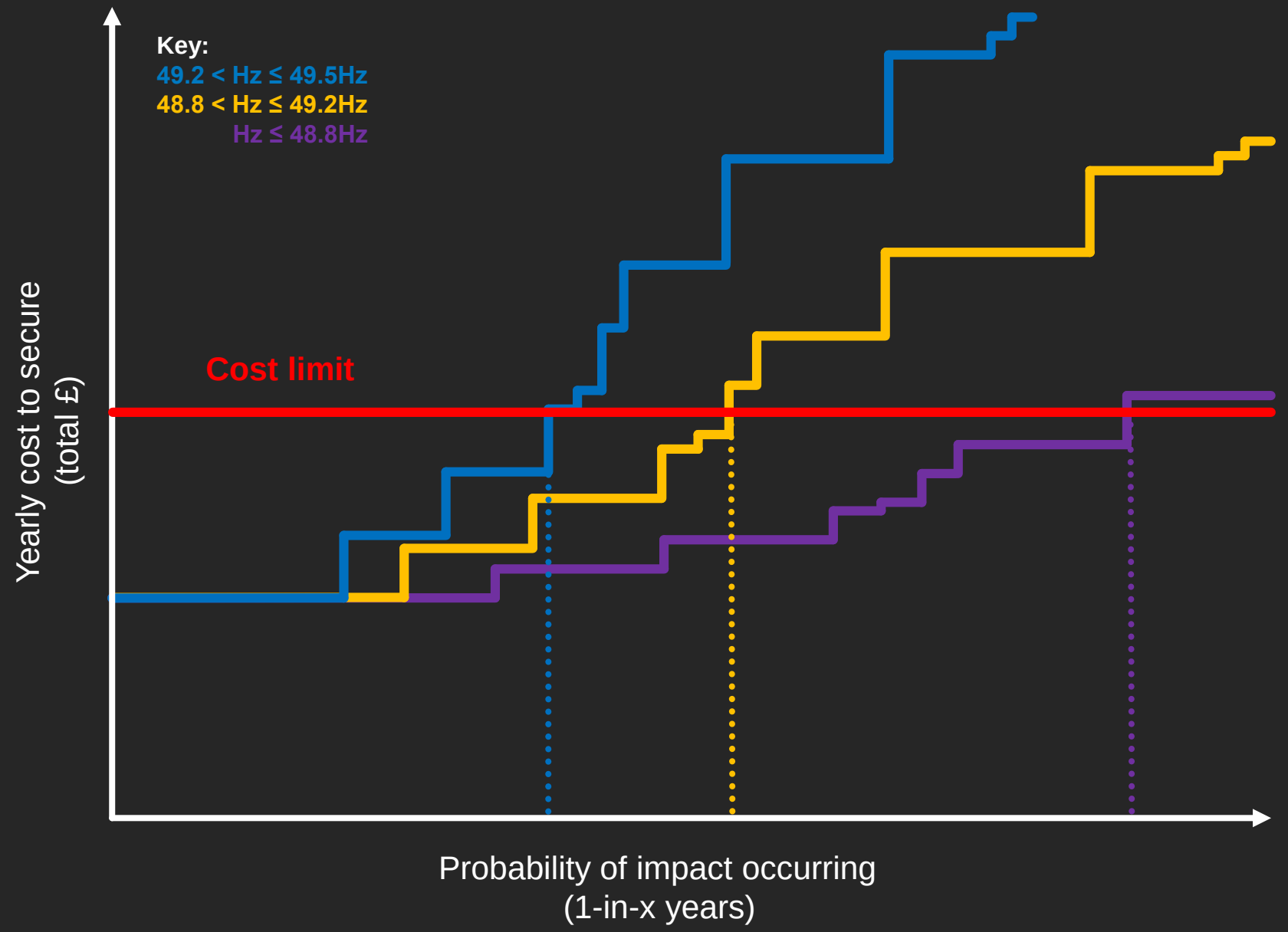
The Report summary will give:

- the expected total cost per year of all frequency controls
- the expected level of reliability achieved for each impact:

#	Deviation	Duration	Likelihood
H1	50.5 > Hz	Any	*e.g. 1 in ___ years*
L1	49.2 ≤ Hz < 49.5	60 seconds	*e.g. 1 in ___ years*
L2	48.8 < Hz < 49.2	Any	*e.g. 1 in ___ years*
L3	47.75 < Hz ≤ 48.8	Any	*e.g. 1 in ___ years*

- the outline policy for system-wide controls used

Reliability vs. cost



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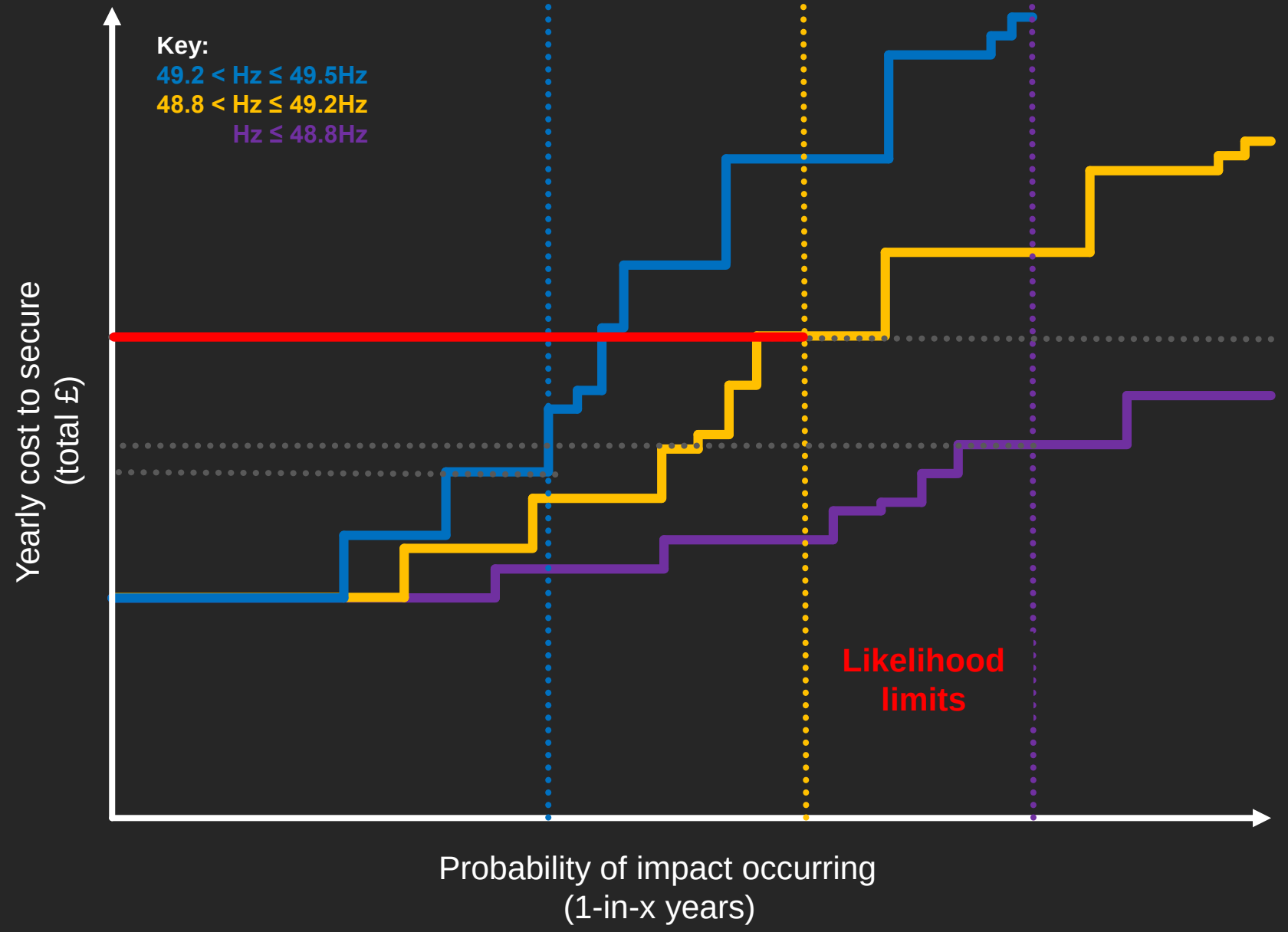

- There are a number of events, loss risks, impacts and controls which are not explicitly considered in this version of the Methodology.

  They will be prioritised for future inclusion in future reports, based on consultation with the industry and the Authority.

- Examples include:

  - Simultaneous events
  - Weather conditions
  - Newly identified events
  - Further investigation of frequency deviations
    - above 50.5Hz
    - close to 50.0Hz
  - New controls
  - Improvements in inputs and data sources

How to respond?

How to respond

1. Overall, do you agree that this methodology will allow the preparation of an appropriate FRCR? (as required by modification GSR027)

2. To help structure comments, do you have any particular feedback on (each section) of the methodology?

3. How well will this methodology address its three key aims?
   a. establish a clear, objective, transparent process for assessing reliability vs. cost to ensure the best outcome for consumers
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4. Do you have any further comments?

Timeline

Milestone	Date
Methodology consultation	21 Dec – 13 Jan 2021
SQSS Panel meeting – decision on recommendation of methodology for use in preparing FRCR	29 Jan 2021
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How to respond

Fill in the proforma which is available on the GSR027 web page and was also emailed round as part of the consultation on 21 Dec 2020 as here:

https://subscribers.nationalgrid.co.uk/t/d-57D9B6E04A0AD4CA2540EF23F30FEDED

Deadline is 13 Jan 2021!

Any problems with this – please contact the Code Administrator at box.SQSS@nationalgrideso.com

Further information

Further information

- The modification to the SQSS (GSR027) was raised in April 2020. It was progressed by a workgroup going through two consultations and was approved by the SQSS panel in Oct 2020 for submission to Ofgem

- Ofgem's decision of 10 Dec 2020 was that SQSS modification GSR027 had a positive impact on the SQSS objectives and it was therefore approved

- The version of the SQSS with which licensees are required to comply needs to be updated by amending the relevant licence conditions. A consultation on this is ongoing (closes 12 Jan) and the changes are planned to be made on 1 April 2021

- It was noted in Ofgem's decision that the ESO's intent is now to develop the first versions of the methodology and FRCR following the process set out in GSR027 such that the FRCR is ready to submit to Ofgem for approval on 1 April 2021 as soon as the licence changes go live

Further information

Dynamic Containment

- https://www.nationalgrideso.com/industry-information/balancing-services/frequency-response-services/dynamic-containment

Accelerated Loss of Mains Change Programme

- https://www.nationalgrideso.com/industry-information/accelerated-loss-mains-change-programme-alomcp
- https://www.energynetworks.org/industry-hub/engineering-and-technical-programmes/accelerated-loss-of-mains

Q&A