UK Critical Minerals Intelligence Centre

UK 2024 Criticality Assessment webinar transcript

Decarbonisation and Resource Management Programme

Department for Business & Trade

BGS British Geological Survey

1 Transcript - Recorded 28/11/24

1.1 INTRODUCTION TO THE CRITICAL MINERALS INTELLIGNCE CENTRE

0:00:04.160,0:00:11.650
Welcome everybody to this webinar. We're still giving
any person that is still queuing to enter the webinar

0:00:11.650,0:00:17.601
a few minutes before we start.
So we'll be starting shortly, but stay tuned.

0:00:20.201,0:00:27.000
So just as a filler we'll do a bit of background
information. So my name is Pierre Josso,

0:00:27.000,0:00:33.855
I'm the deputy director of the Critical Mineral
Intelligence Centre at the British Geological Survey.

0:00:33.855,0:00:40.080
And for this webinar I am joined by
Gavin Mudd, who is the director of CMIC and

0:00:40.080,0:00:47.080
Jon-Paul Orsi, which will be our facilitator for this
session. So the webinar, as I said, will start

0:00:47.080,0:00:52.760
in a few minutes with a presentation on how
the assessment was conducted over the last

0:00:52.760,0:00:58.960
few months or so by the CMIC team. And we will
present an overview of the main findings from

0:00:58.960,0:01:05.800
this iteration of the UK Criticality Assessment.

And the rest of the webinar after that will be

0:01:05.800,0:01:12.840
a Q&A which will be open to all participants,
so please use the Q&A function at the bottom of

0:01:12.840,0:01:19.935
your screen. We will do our best to answer as
many questions you may have during this session.

0:01:19.935,0:01:24.387
Some of those may be answered in writing
so please keep an eye on this.

0:01:24.820,0:01:31.320
If some of those questions are a bit, well...
really getting into some details that we may

0:01:31.320,0:01:36.480
not necessarily be able to answer straight away
during the Q&A, we will do our best to take it

0:01:36.480,0:01:40.683
away with us and send them some answers
later down the line.

0:01:41.279,0:01:45.220
So I think we probably have enough
people that have joined.

0:01:45.220,0:01:48.982
We have currently about 250 people plus
that have joined.

0:01:48.982,0:01:54.747
So it's my pleasure to introduce you,
Gavin, for this presentation.

0:01:55.885,0:01:57.353
Okay, thank you Pierre.

0:02:01.600,0:02:06.040
I'd first of all like to acknowledge the
Department for Business and Trade for

0:02:06.311,0:02:13.038
the funding, I guess, we receive is from them,
and so the programme of work for this year,

0:02:13.038,0:02:18.700
the major project of course was the big a update
on the Criticality Assessment for the UK.

0:02:19.513,0:02:23.291
So I'd just like to sort of acknowledge their role
and their support throughout this sort of process

0:02:23.291,0:02:24.350
for most of this year to date.

0:02:25.217,0:02:27.440
I'd also like to acknowledge Pierre, my deputy

0:02:27.440,0:02:32.329
but also the entire CMIC team. We've got a sort
of large team here that has done a lot of work

0:02:32.329,0:02:41.200
and put in a lot of hard hours in pulling together
the data, and basically the whole assessment.

0:02:41.200,0:02:43.232
So, let's get started.

1.2 METALS, MINERALS & ENERGY

0:02:45.000,0:02:51.298
When we're looking at mining
we're thinking about metals, we're thinking about minerals,

0:02:51.948,0:02:56.931
we extract different resources from
the Earth for energy in various ways

0:02:57.256,0:03:02.529
and so mining has really changed. We've moved from sort
of much smaller scale mining to much sort of larger scales

0:03:02.787,0:03:08.851
to really meet the demands of a growing population, but
also the fact that we're using more and more all the time.

0:03:08.851,0:03:12.293
So not only do we need a wider variety of metals now,

0:03:12.293,0:03:16.443
if we look back over history as we can see
on the sort of right hand figure there at the bottom

0:03:17.093,0:03:21.767
we also need more and more of them.
And so this constant technological evolution

0:03:21.767,0:03:25.867
is really what's driving a lot of the change
we see in our modern world.

0:03:26.355,0:03:31.334
Whether it's renewable energy, whether it's
electric vehicles, whether it's digital technology,

0:03:31.826,0:03:37.452

without forgetting traditional industries like
agriculture and construction and others as well. So

0:03:37.452,0:03:40.512
a lot of these sectors are obviously pretty important.

0:03:41.920,0:03:46.231
But we want to make sure we do mining right, and
we want to make sure that we've got a responsible

0:03:46.231,0:03:52.623
sort of supply chain, you might
call that a sustainable supply chain as well, so

0:03:52.623,0:03:57.330
we need these materials, and we need to understand
where they come from, and then how we use them,

0:03:57.330,0:04:01.026
and what to do with them once we've finished
using them.

1.3 WHAT ARE CRITICALITY ASSESSMENTS

0:04:02.600,0:04:05.072
That's where our Criticality Assessment comes in.

0:04:05.397,0:04:08.598
And a criticality assessment
allows us to sort of rank

0:04:08.923,0:04:14.543
those materials, those minerals, those metals
that are at higher risk.

0:04:15.000,0:04:20.664
Now when we say risk, there's really two parts

we typically look at for a criticality assessment.

0:04:20.664,0:04:23.960
And so the first one is really the supply disruption.

0:04:23.960,0:04:31.120
So is there a chance, or a risk that the supply of
whether it be cobalt, or platinum group elements,

0:04:31.120,0:04:36.360
or other elements we're interested in,
are they at risk of being disrupted and therefore

0:04:36.360,0:04:37.781
we won't have that supply?

0:04:38.593,0:04:41.458
The next question, or the dimension that
we have to think about

0:04:41.458,0:04:48.971
is what's that impact? So how vulnerable are we to
an instance of a supply disruption?

0:04:49.350,0:04:55.640
So if we look at cobalt for example, in the Congo,
in central Africa there in the late 1970s

0:04:55.640,0:05:01.080
there was civil unrest that lasted the best part of
20 years, and so for the aerospace sector

0:05:01.080,0:05:06.342
which was one of the major users of cobalt coming
from the Congo, they went to substitution.

0:05:06.776,0:05:12.440
So the higher price basically wasn't tenable for them

so they worked hard and developed a substitution

0:05:12.440,0:05:14.757
as their approach to solving that problem.

0:05:15.949,0:05:18.591
Rather than just waiting for these problems to occur

0:05:18.591,0:05:23.983
the Criticality Assessment is really a risk assessment,
it's basically a process where we can identify

0:05:23.983,0:05:30.000
those metals, minerals, and potentially
energy etc. that's at risk of a supply disruption

0:05:30.200,0:05:34.480
and then trying to understand what's the
potential impact of that. So in other words

0:05:34.480,0:05:36.480
how vulnerable would the UK be?

0:05:37.134,0:05:41.120
Once we're finished that process,
we choose a threshold and we say

0:05:41.120,0:05:46.021
this is our pain point, so to speak.
This is the sort of stuff, the line where

0:05:46.021,0:05:51.000
above this line, that's really really important, and
so we're really concerned about those ones

0:05:51.000,0:05:55.553
and they're critical minerals, so they're the
ones that we really want to emphasise as the...

0:05:55.553,0:06:00.686
probably being the more important to solve
relative to others. Now

0:06:01.065,0:06:05.782
stuff that's not designated critical doesn't mean
we don't use them, and I'll come back to this point,

0:06:06.595,0:06:10.600
it just means that from a risk assessment point of view
we're looking at critical minerals as those that

0:06:10.600,0:06:16.083
really require, I suppose more attention, and are at
greater risk of supply disruption or things like that.

0:06:16.083,0:06:20.218
And so that's the process that we go through
in doing a criticality assessment.

0:06:20.760,0:06:25.459
Basically looking at those risks, pulling
together all of the data, and then analysing that.

1.4 2021 CRITICALITY ASSESSMENT, 2022 CMIC

0:06:28.439,0:06:33.316
Look at the previous assessment that was done
for the UK, it was done about 3 years ago.

0:06:33.316,0:06:39.360
And it looked at just 26 materials, and
they were largely focused around technology

0:06:39.360,0:06:42.902
and often a lot of decarbonisation,

but also digital technologies.

0:06:43.335,0:06:47.356
And out of that there was 18 designated as critical minerals

0:06:47.356,0:06:49.112
and we can see the results on the right.

0:06:49.653,0:06:52.640
So on the bottom we have UK economic vulnerability.

0:06:52.881,0:06:57.293
On the left hand side, or the Y axis,
we have that Global supply risk.

0:06:57.594,0:07:03.813
And so the quadrant approach, so we have a
threshold basically of 1.4 for each dimension,

0:07:03.813,0:07:09.754
and so that gives rise to that sort of orange quadrant
which is where the critical minerals are derived from.

0:07:10.837,0:07:14.640
After that, the UK Government
provided funding to establish

0:07:14.640,0:07:19.016
the Critical Minerals Intelligence Centre
here at the British Geological Survey

0:07:19.016,0:07:21.708
and that's managed through
the Department of Business and Trade.

0:07:21.708,0:07:26.367
There was also the Critical Minerals Strategy
under the previous government that was launched.

0:07:26.367,0:07:31.371
A refresh done in March 23 and...
we're now in the process of developing

0:07:31.371,0:07:34.938
a new Industrial Strategy for the UK
and then there'll be...

0:07:34.938,0:07:40.478
in response to that there will be a new
Critical Minerals Strategy developed as well.

1.5 UK 2024 CRITICALITY ASSESSMENT

0:07:42.970,0:07:48.603
If we look at where we're up to now, in the past
couple of years we've been doing a lot of work.

0:07:48.603,0:07:52.202
We've done a whole project looking at
that whole methodology and the

0:07:52.202,0:07:55.556
detailed calculations behind
criticality assessments.

0:07:56.264,0:08:00.790
We also wanted to expand the scope.
One of the problems of course last time

0:08:00.790,0:08:05.879
is that a whole range of sectors, including some
traditional sectors like agriculture or construction,

0:08:05.879,0:08:08.608
the materials required for those weren't really included.

0:08:08.987,0:08:14.322
So we wanted to make sure that we capture
really the breadth and depth of the UK economy

0:08:14.322,0:08:19.624
so that we can make sure we understand the
material basis for the UKs economic activities.

0:08:20.328,0:08:26.684
The scope was expanded to 82 candidate materials,
and I use materials in a very general sense,

0:08:26.955,0:08:32.677
and we use minerals, or critical minerals,
for ones that get designated as so

0:08:33.177,0:08:37.469
but acknowledging that when we say critical minerals
things like helium, for example, is a gas.

0:08:37.947,0:08:42.439
We can see here, we've got most of the
periodic table sort of laid out here

0:08:42.439,0:08:46.330
and we can also see the family of rare-earth
elements in there as well.

1.6 RISK ASSESSMENTS AND CRITICALITY

0:08:49.201,0:08:54.080
Now I mentioned we take a risk assessment
approach and part of the work that was done

0:08:54.080,0:08:58.881
and it was work led by Pierre
before I joined CMIC a year ago, but

0:08:59.423,0:09:04.243
changing the way we look at risk,
and certainly within a criticality assessment.

0:09:04.731,0:09:07.745
If we look at the left hand side of the box here

0:09:07.745,0:09:11.160
we can see that quadrant approach,
so we have a threshold for vulnerability,

0:09:11.160,0:09:15.707
we have a threshold for supply,
and you have to be above both of those

0:09:15.707,0:09:18.861
in order to make sure you are
inside that high quadrant.

0:09:19.674,0:09:22.920
Now, when you're looking at that,
in risk management

0:09:22.920,0:09:28.613
we often think of a high probability and a low severity
risk as we might rank that as a medium risk

0:09:29.046,0:09:34.156
but if we have a low probability and high severity risk
that's still a medium risk.

0:09:35.077,0:09:40.543
So they're about the same, and so when you're looking
at that, if we go to the little graph in the middle here

0:09:40.543,0:09:46.520
if we take our value of four as our threshold for risk,
we can see that there's you know

0:09:46.520,0:09:51.240
some ones down the sort of bottom here that are
below the threshold, say for supply risk, but certainly

0:09:51.240,0:09:57.194
above the threshold for vulnerability, and
vice versa on the left-and axis over here too.

0:09:58.440,0:10:04.622
And yet the scores are about the same, so from a
risk assessment point of view you've got a 5.2 here

0:10:04.622,0:10:09.186
you've got a five sort of in the middle there
and then another 5.2 up the top here.

0:10:09.186,0:10:14.217
So they're really scoring about the same.
Now if we increase the resolution of that and sort of

0:10:14.217,0:10:19.633
start to calculate it out in a more detailed way,
remembering that when we're calculating risk

0:10:19.633,0:10:24.455
we're taking the square root, or the geometric mean
of the product of probability and severity

0:10:24.943,0:10:28.978
in our case for criticality assessment
that means vulnerability and supply

0:10:29.520,0:10:33.317
we can calculate that risk score, or criticality score.

0:10:33.751,0:10:41.920
And so if we choose a value of four as our threshold for

distinguishing what we call critical versus important but not critical

0:10:41.920,0:10:47.840
we can see we get a curve, and that starts to
allow us to really understand the equivalence.

0:10:47.840,0:10:53.396
So risks that have a high probability or
high vulnerability and low supply risk

0:10:53.396,0:10:59.240
versus those that have maybe a lower
vulnerability but certainly a high supply risk.

1.7 UK 2024 CRITICALITY ASSESSMENT METHODOLOGY

0:11:03.120,0:11:08.200
So part of the work that we've done in
the previous year, previous financial year was a

0:11:08.200,0:11:14.329
basically a revamp of the methodology.
So there's various factors, or indicators that we use

0:11:14.329,0:11:19.552
to calculate the global supply risk. We can see there
that we're looking at production concentration

0:11:19.769,0:11:26.966
so where in the world does mining and refining occur?
Looking at global trade, the net imports by country.

0:11:26.966,0:11:32.278
The companionality, some metals like cobalt are
a co-product or a byproduct, so you have to mine

0:11:32.278,0:11:37.289
the copper or the nickel first, but also thinking

about recycling. Where, how much

0:11:37.289,0:11:42.296
are we actually doing in recycling, because
that can be an important secondary supply.

0:11:42.296,0:11:47.672
So we put all of that together. We also use some
weighting factors, and those weighting factors are chosen

0:11:47.672,0:11:52.929
based on the quality of the data and where we
think the most influence is, and that's helped

0:11:52.929,0:11:59.240
chosen with our stakeholder engagement.
Then we look at economic vulnerability along the bottom

0:11:59.840,0:12:05.558
and that's based on apparent consumption, and that's
using economic data to look at any UK production

0:12:05.558,0:12:10.456
plus imports, and then minus any exports.
And that's done on a value basis for the UK.

0:12:10.998,0:12:16.240
We look at net import reliance and we calculate
that as a percentage. So to do that we calculate

0:12:16.240,0:12:20.992
the difference between imports and exports and
apparent consumption calculated on a mass basis.

0:12:22.400,0:12:27.280
This time we chose to keep the links into the
gross value added, which is understanding

0:12:27.280,0:12:32.800
the economic sectors for different materials get
used in. So if we're looking at an element such

0:12:32.800,0:12:38.720
as rhenium, it gets used in the aerospace sector,
in jet turbines, so the use of that rhenium

0:12:38.720,0:12:41.902
is attributed to the gross value added
for making jet turbines.

0:12:41.902,0:12:46.344
And so if we think about our previous assessment

0:12:46.344,0:12:53.493
our 2021 assessment, I've just taken some examples
from that, we've got germanium, tantalum, tin

0:12:53.493,0:12:58.670
and then nickel. And so if we look at that
we can see that using the quadrant

0:12:58.670,0:13:04.853
certainly tantalum and tin were designated as critical
but nickel and germanium were not.

0:13:05.557,0:13:11.743
Now if we're looking at it from the way that we now view
risk as the product of our vulnerability and our supply

0:13:11.743,0:13:18.613
and the square root of that, we get this line.
And so we could say that if we use that line

0:13:18.613,0:13:24.961
germanium and nickel would certainly be included
as critical minerals, but tin would still be excluded.

0:13:25.990,0:13:31.549
So if we think about the significance of that,
if we chose our value of four on our threshold

0:13:31.874,0:13:38.284
and replotted that, we'd use the yellow line
and we'd be able to incorporate all of those.

0:13:38.284,0:13:45.000
Ultimately when we're looking at say nickel versus tantalum
versus germanium there, they're all about the same level of risk.

0:13:45.000,0:13:49.450
So if they're about the same level of risk, then
they should all really be called critical minerals

0:13:49.450,0:13:53.743
because they're all about the same.
And tin, if we choose the threshold of four

0:13:53.743,0:13:56.115
tin would still be, would obviously still be in.

0:13:56.982,0:13:59.560
So we think this is a really important approach and

0:13:59.560,0:14:05.756
a good sort of, you know, step forward I guess for
the way we approach assessing criticality and then

0:14:05.756,0:14:07.450
deriving a critical minerals list.

1.8 UK 2024 CRITICALITY ASSESSMENT RESULTS

0:14:09.075,0:14:11.075
Let's look at our results.

0:14:12.700,0:14:15.458
This is the way our 2024 results look.

0:14:15.729,0:14:19.480
There's certainly some changes we've made
I guess to the candidate list. There's some

0:14:19.480,0:14:24.600
commodities for which there's insufficient data
to reliably plot, we can see that list down at

0:14:24.600,0:14:29.760
the very bottom, in the fine print. But there's
some stuff that stands out. A lot of the list

0:14:29.760,0:14:36.000
above our threshold of four are very commonly
assessed as critical. We have tungsten there as W,

0:14:36.000,0:14:44.440
we have our rare-earth elements - REE, cobalt,
germanium, gallium, we also have zinc there, tin

0:14:44.440,0:14:53.400
for example, lithium, but we also have iron. Now we
believe we're the first in the world to actually

0:14:53.400,0:14:59.473
list iron as a critical mineral, and we think
it's actually the right interpretation.

0:15:00.040,0:15:06.000
If people are interested I have the EU plot to
show them later. But where iron plots in our graph

0:15:06.000,0:15:11.566
just to the right there, in terms of very high economic

vulnerability and a sort of a modest supply risk

0:15:12.433,0:15:16.760
it's clearly above the line.
It's clearly therefore critical. There is a

0:15:16.760,0:15:23.000
lot of sectors that of course the UK uses iron for.
It connects into the automotive, the construction,

0:15:23.000,0:15:29.252
aerospace, and others. So we believe
iron is certainly correctly identified.

0:15:29.469,0:15:35.936
Another result that may be a bit unexpected
is palladium, which it's literally just outside.

0:15:35.936,0:15:41.880
Palladium, being a platinum group element, is always
associated with platinum, rhodium, ruthenium and iridium.

0:15:41.880,0:15:48.560
So we can sort of see these just above platinum
up here, so we don't believe that's going

0:15:48.560,0:15:53.640
to cause any issues in the way that you know
say all platinum group elements will be dealt with.

0:15:53.640,0:15:59.400
It's a recognition that palladium is more widely
supplied, and has a lower supply risk, effectively.

0:15:59.400,0:16:05.409
But copper, we can see sort of down the bottom
of the graph here, copper is not critical.

0:16:05.409,0:16:08.567
And that's because it is reasonably well
supplied at the moment.

0:16:09.271,0:16:13.940
And we're looking at the economic value in the way
that we use copper, which is in our electricity systems,

0:16:13.940,0:16:19.011
it's in our electronics, it's in our homes,
we certainly have a wide use of copper.

0:16:19.282,0:16:25.182
But it's not as high a value across the UK economy
compared to things such as iron.

0:16:25.182,0:16:30.336
And so it has a lower economic vulnerability
relative to iron, and so it plots well below.

0:16:31.365,0:16:34.600
And we recognise, and this is in our report,
we certainly recognise

0:16:34.600,0:16:39.760
that there are very legitimate concerns around
the ability for the copper sector globally

0:16:39.760,0:16:45.615
to continue to increase supply to meet things such
as Net Zero, and we certainly go into that into the report

0:16:45.615,0:16:50.360
where we look at some of the scenarios,
and that increase in copper mining that we need

0:16:50.360,0:16:53.568
to be able to meet our targets such as our Net Zero.

0:16:54.653,0:17:01.209
Another important example from these
results are things like kaolin clay which is

0:17:01.209,0:17:05.122
right down the bottom left, and the UK
has a very large export industry for that.

0:17:05.988,0:17:11.135
Previously of course, up until 2023,
the UK used to mine fluorspar.

0:17:11.839,0:17:19.492
If we look at fluorspar now, those mines stopped and are being
closed down, and are in the process of being rehabilitated.

0:17:20.196,0:17:26.799
If we change the data at the moment to reflect the fact
that the UK would now be 100% net import reliant

0:17:27.504,0:17:32.780
fluorine would shift very significantly across to the right
and would be above the threshold of four,

0:17:32.780,0:17:34.580
it would sit close to a value of five.

0:17:34.959,0:17:41.792
And so if that was the case fluorine shifts. And it's a
reminder, as we see with copper, and as we've seen with

0:17:41.792,0:17:46.099
other elements as well, criticality is very dynamic,
it's constantly changing.

0:17:46.099,0:17:51.144
And so it's why we always need to keep these sort

of assessments updated and moving forward.

1.9 UK 2024 CRITICAL MINERALS LIST 2024

0:17:53.690,0:17:57.646
So let's look at our results on a periodic table.

0:17:58.242,0:18:02.880
And again, this is our spread, so we can see all the
rare-earth elements along the sort of the bottom here.

0:18:02.880,0:18:10.333
We can also see a lot of the iron related elements
such as manganese and nickel, vanadium.

0:18:11.633,0:18:16.290
We see our four platinum group elements there
in the middle, and a range of others that are there.

0:18:16.290,0:18:20.959
And so for sodium, it's not salt - we
don't want any confusion about that.

0:18:21.447,0:18:28.120
The sodium there is listed which is sodium compounds,
and by that we mean sodium carbonate, sodium nitrate

0:18:28.120,0:18:33.320
and sodium metal, which is a minor part of that
sort of trade code. So sodium compounds there.

0:18:33.320,0:18:39.251
And for magnesium, we mean both magnesium
metal as well as the industrial mineral magnesite.

0:18:40.280,0:18:46.267
So for the carbon there, we're looking at natural
graphite as the material that we've listed as critical.

0:18:46.700,0:18:53.115
So that's our list, it's 34 in total,
and we think it's a pretty well justified list.

1.10 COMPARISON CRITICAL MINERALS LISTS

0:18:55.878,0:19:00.543
If we compare the way a new list for the UK,
and this is... again this is a UK assessment

0:19:00.543,0:19:05.497
we're not the EU; we're not Australia; we're not
Canada; we're not other countries around the world

0:19:05.497,0:19:10.960
this is specific to the UK, so there should
be some differences. And given the commonality

0:19:10.960,0:19:15.807
and the main technologies that we're all using
of course there should be some overlap as well.

0:19:16.132,0:19:20.675
And we can see with the European Union on
the bottom left here there is a lot of overlap.

0:19:20.675,0:19:25.920
So it's the rare-earth elements, it's cobalt,
a lot of the different alloy elements, the

0:19:25.920,0:19:32.520
platinum group elements, and so on. If we compare
to Australia we can see again a lot of the same

0:19:32.520,0:19:38.920
elements and the same materials being listed.
One of the key factors there for the European Union

0:19:38.920,0:19:44.768
is that nickel and copper, just like our results for
copper at least, didn't meet the criteria for critical

0:19:44.768,0:19:50.248
but the EU has decided to add that to their strategic
minerals list under their critical raw materials act.

0:19:50.844,0:19:57.120
For Australia, they recognise that
copper, zinc, aluminium, phosphorus and tin

0:19:57.120,0:20:02.400
also didn't meet the criteria that they used
for designating critical minerals and so they've

0:20:02.400,0:20:05.507
established those as their own strategic minerals list.

0:20:07.132,0:20:11.840
And that's an important point, I suppose that
in difference, we haven't recommended that here.

0:20:13.195,0:20:19.545
If we compare the UK list on the top to the two
main lists or ways that the US looks at things

0:20:20.249,0:20:24.473
on the left hand side we see the US Geological Survey
which is a national assessment

0:20:24.798,0:20:30.731
and so that's comprehensive like the UK, and again
mostly the same but some differences there.

0:20:31.336,0:20:36.109
If we look at the US Department of Energy

it's looking at just energy technologies only

0:20:36.109,0:20:42.778
and it does list electrical grade steel, so a specific
alloy designed for use in energy technologies,

0:20:43.048,0:20:45.644
so not iron in total.

0:20:46.623,0:20:52.641
But again, their list is much smaller because they're only
looking at the materials required for energy technologies.

1.11 KEY TECHNOLOGIES & MATERIALS

0:20:56.704,0:21:00.271
If we look at the way that our plot, our results

0:21:01.084,0:21:05.724
might appear if we're looking at different technologies.
So across the top here we've taken our plot

0:21:05.994,0:21:09.117
and picked out different components
in digital technologies

0:21:09.334,0:21:14.289
and looked at the things, whether it's the sort of the batteries,
whether it's the actual electronics and the chips,

0:21:14.560,0:21:16.127
or the colour screens.

0:21:16.402,0:21:22.333
And we can see a lot of the materials sit above
the threshold, but some actually still sit below.

0:21:22.821,0:21:24.008

So they're still important.

0:21:24.717,0:21:30.507
If we look at wind turbines, or solar panels,
and also aerospace or jet turbines, for example

0:21:30.507,0:21:35.903
we can see that many elements sit above the line
but there's still a lot of other elements sitting below.

0:21:36.120,0:21:40.415
And so they're still important, they will require
a different policy response I guess.

0:21:41.065,0:21:45.000
So it's not that we're saying say copper
isn't important, it's just that it's not critical.

1.12 SUMMARY

0:21:48.859,0:21:53.880
So, out of all of that, we believe our assessment
certainly is the most comprehensive

0:21:53.880,0:21:58.272
of the UK to date. We've looked at 82 raw materials,
we've gone through in great detail.

0:21:58.922,0:22:05.560
We've looked at using a revised methodology, and we
believe using a curve, using this sort of equivalence

0:22:05.560,0:22:11.803
approach, from a risk management sort of approach,
really allows better justification of our critical minerals.

0:22:11.803,0:22:17.649
So that way we really do get a more equal sort of footing

to be able to decide what is critical and what isn't.

0:22:18.462,0:22:24.077
Out of that we've used a threshold of four
and we get to 34 critical minerals.

0:22:24.348,0:22:28.520
And so iron is included but we don't include
copper and palladium, for example.

0:22:29.320,0:22:35.723
We believe the rest should still be maintained on a
watch list, and as we've seen like fluorine or fluorspar

0:22:35.723,0:22:37.353
things can change pretty quickly.

0:22:37.624,0:22:40.845
Not only within the UK context
but also in a global context.

0:22:40.845,0:22:44.442
So that's important.
So there's some of the key sort of findings.

0:22:45.000,0:22:48.726
Areas for recommendations -
we think there's a lot of work that we can do

0:22:48.726,0:22:53.147
and this links to, I guess, to sort of the
industrial strategy that's looking to be developed

0:22:53.147,0:22:56.068
at the moment in the UK, but looking at the midstream

0:22:56.397,0:23:01.613
and looking at the material flow. So really understanding

not just the primary raw materials

0:23:01.613,0:23:05.161
but understanding materials as they flow
through the economy in whole.

0:23:05.919,0:23:10.736
We also think we need to look at better methods
that we can understand the impacts of trade barriers

0:23:10.736,0:23:14.485
but also trade relationships.
It's something that we started to look at

0:23:14.485,0:23:19.139
and we felt that wasn't appropriate to be able
to include it that in this assessment.

0:23:20.172,0:23:23.723
We think there's a role to say
there's a need for deep dive studies

0:23:23.723,0:23:27.307
so we can do some detailed global studies
on say copper

0:23:27.307,0:23:31.940
some detailed studies on iron in the UK
and really looking at the material flows

0:23:31.940,0:23:36.344
and understanding the potential for recycling
the different alloys. We want to make sure that

0:23:36.832,0:23:40.146
we maintain those properties of the different
alloys for which iron is used.

0:23:40.634,0:23:43.503
Things like tantalum, critical for our electronics sector

0:23:43.754,0:23:47.833
but also tungsten, where the UK...
and maybe lithium as well, we could add there

0:23:48.375,0:23:52.817
where the UK has some prospective
you know mining potential in the near future.

0:23:53.412,0:23:56.384
But also looking at different technologies that are on the rise

0:23:56.384,0:24:01.794
whether that be energy storage batteries, but especially
the information and computing technology.

0:24:02.281,0:24:07.314
ICT as it's often called. And so the rise of
quantum computing we think could present some

0:24:07.314,0:24:11.253
pretty important challenges in terms of
material needs and things like that.

0:24:12.553,0:24:17.022
Where we believe there is future potential for
UK domestic production

0:24:17.022,0:24:22.000
there's a lot more work that needs to be done
to set up the pre-competitive data for that

0:24:22.000,0:24:24.618
and that's things like geophysical surveys and so on.

0:24:25.160,0:24:30.000

Given some of the global sort of
geopolitical context and the sort of landscape

0:24:30.000,0:24:35.513
we think there's also a need to be able to develop
some methods that allow us to do a rapid response.

0:24:35.946,0:24:41.896
So if there's a particular issue, there's a
supply chain disruption of some sort

0:24:41.896,0:24:47.521
such as we've seen with Hurricane Helene
that recently went through North Carolina and

0:24:47.521,0:24:52.815
basically caused severe impacts on a high-purity
silicon mine which is used for making silicon chips.

0:24:53.736,0:24:58.846
What's the response, what's the sort of impact of that?
So we need to improve our capacity to do that.

0:24:59.604,0:25:02.720
But also we need to make sure that
given everything is dynamic

0:25:02.720,0:25:05.124
and given some of the changes
that we're seeing globally

0:25:05.612,0:25:09.834
we need to make sure we keep this effort going
so we can make sure we support our industries

0:25:09.834,0:25:15.809
and move forward and yeah
keep the UK in it's good productive state.

0:25:16.351,0:25:19.837
Finally, I'd just like to point people
to the fact we'll be having

0:25:19.837,0:25:23.938
our second annual CMIC Conference
next year, early next year.

0:25:24.480,0:25:29.110
That will be held here at Keyworth in Nottingham
on the 26th of February so

0:25:29.110,0:25:33.944
If you'd like to go to our website, you could certainly
sign up for either our newsletter or information

0:25:33.944,0:25:36.673
or send us an enquiry and we'd be happy to respond.

0:25:36.902,0:25:40.219
And yeah, hopefully we might see you here in Keyworth.

2.3 Acknowledgements

0:25:42.156,0:25:43.472
Just to finish with some acknowledgements.

0:25:43.472,0:25:49.286
I would just like to acknowledge the funding that we do receive from...
through the Department for Business and Trade

0:25:49.286,0:25:52.975
without that we wouldn't be able to do this sort of
work and support the UK Government.

0:25:53.354,0:25:57.938
I'd also like to acknowledge the whole team here,

it's a very large team and we've worked hard for

0:25:57.938,0:26:04.463
many months this year to get to the point of having the
project finished now and launched like we are doing.

0:26:04.734,0:26:07.530
I'd also like to acknowledge the various
stakeholders we've engaged with

0:26:07.530,0:26:10.950
and the consultation processes and
all the written submissions we've had.

0:26:10.950,0:26:17.669
It certainly helped us to basically build that content into
the report and make sure that the report really speaks to

0:26:17.669,0:26:21.956
what's critical, what's important
and various pathways forward.

0:26:21.956,0:26:23.631
Thank you.

2 Q&A Session

0:26:30.280,0:26:35.977
Now, I think we're happy to move to the
Q&A session. So... J.P.

0:26:37.331,0:26:42.760
Brilliant. Listen, thank you very much, Gavin, for that great
introduction and overview of this Criticality Assessment

0:26:42.760,0:26:49.361

that launched today, and thank you to the 290,
almost 300 that have taken time to join us live

0:26:49.361,0:26:51.601
for this presentation, it's greatly appreciated.

0:26:52.034,0:26:56.849
Without further ado, we'll dive straight in to the Q&A.
There's lots of great questions already come in.

0:26:56.849,0:27:00.000
Still plenty of time to get your questions in,
and as Pierre said at the start

0:27:00.000,0:27:06.098
if we don't have time to answer them live we'll do our very
best to follow up with written responses to your questions.

0:27:06.423,0:27:12.633
I think it's only fair that we start off by asking Pierre the first question
and give yourself a chance to catch your breath Gavin.

0:27:12.916,0:27:20.160
**So Pierre, what proportion of our critical minerals use
could be satisfied through more or better recycling
i.e. of consumer electronics, car batteries?**

0:27:23.537,0:27:28.484
Well, I think everybody would love to have an exact number.

0:27:28.840,0:27:36.480
Effectively there is definitely an enormous
amount of raw material, critical minerals, metals

0:27:36.480,0:27:43.040
whichever substance you consider, that we
could valorise if we improve the collection

0:27:43.040,0:27:51.040
the recovery of those materials. Being able to
explicitly define a volume at the end of the day

0:27:51.040,0:27:56.560
for each of those is very difficult. We have all
our data for each of those materials which is

0:27:56.560,0:28:00.446
detail in the annexes if you want to have a look
at specific commodities.

0:28:00.446,0:28:08.164
But effectively putting in place an improved circular
economy is definitely a way of reducing supply risk

0:28:08.164,0:28:14.063
by having a better collection and keeping
resources domestically.

0:28:14.063,0:28:23.688
That also entails the fact that we would put in place the
recycling system in the UK as well, not to export those waste

0:28:23.688,0:28:27.343
abroad and effectively lose control of this resource.

0:28:27.343,0:28:29.506
I hope that answers part of the question.

0:28:30.376,0:28:38.255
Yeah, another comment I'd add in there as well is it entirely
depends on the material you're looking at, but a lot of them...

0:28:38.255,0:28:43.080
we don't have enough in our urban systems yet
to really feed the flows for recycling anyway.

0:28:43.080,0:28:47.640
So we're looking at electric vehicle batteries,
we're moving from the old lead acid batteries

0:28:47.640,0:28:53.880
in combustion vehicles to lithium based batteries
in electric vehicles, and so it'll be some years

0:28:53.880,0:29:00.980
before we've got the electric vehicle fleet and the
batteries within that become available for recycling.

0:29:00.980,0:29:05.809
So which is fine, that gives us
time to look at the recycling policies

0:29:05.809,0:29:11.320
any regulatory requirements, any R&D. So we
can actually... we've got time to sort of build

0:29:11.320,0:29:16.480
towards that circular economy and improving
the way that recycling can help us achieve that.

0:29:20.218,0:29:26.547
Great, thank you both. Next question. Did you, sorry.

Did you consider the import and export of minerals containing products e.g. electric vehicle batteries, when calculating the criticality?

0:29:34.848,0:29:39.158
That's always a good question.
Our assessment is very much a raw material assessment.

0:29:39.158,0:29:45.651
We haven't gone through and tried to estimate the amount
of materials that sit in products, for example.

0:29:45.651,0:29:49.576

So if you've got an importation of an electric vehicle

0:29:49.576,0:29:54.620
that vehicle would contain copper, it would contain lithium,
it would contain lots of different steels

0:29:55.595,0:30:00.262
and a whole range of other things, and especially given
the increasing amount of electronics in vehicles

0:30:00.262,0:30:06.219
as well, there's that side to consider. So... and if we
were to do that, I mean yeah, conceptually, yes

0:30:06.219,0:30:11.518
it's theoretically possible, but that would be an
extraordinarily large project to be able to undertake

0:30:11.518,0:30:15.970
and especially if you're looking at 82 commodities
and then you're thinking about the

0:30:15.970,0:30:22.712
all the different products that... and different materials,
components, semi-manufactured goods etc.

0:30:22.712,0:30:27.840
coming in and out of the UK, that would be
an extraordinarily large project. So our focus

0:30:27.840,0:30:34.994
in line with the way that these assessments are done
in the EU, in the US, and you know, Japan and elsewhere

0:30:34.994,0:30:41.014
is really focused on the raw materials, and that's the
sort of the underpinning basis of a criticality assessment.

0:30:42.219,0:30:48.416
And I would add to this effectively because there were a few other
questions in the chat that kind of highlighted this phenomenon.

0:30:48.760,0:30:57.091
And effectively we also hit the resolution of the data
that is available to conduct those type of exercise whereby

0:30:57.091,0:31:04.581
it is impossible to get clear pictures of the
metal content which might be incorporated within

0:31:04.581,0:31:09.735
such a diversity of different technology, product,
chemical product, and so on.

0:31:09.735,0:31:18.936
And effectively disentangling trade data on this level
would be an absolute feat to conduct and a very very large project.

0:31:19.911,0:31:25.074
It's not to say that we haven't done such analysis
but we are doing similar exercise

0:31:25.074,0:31:29.800
more when they are technology focused
and we're doing a top to bottom approach

0:31:29.800,0:31:35.960
whereby we are investigating the chemical
composition of all the components and add in

0:31:35.960,0:31:42.713
manufacturing stage from the end product through to
the mining sector and those are much more detailed

0:31:42.713,0:31:47.208
into some other reports in the foresight studies

which are going to be released fairly soon.

0:31:50.621,0:31:57.905
Great, thank you both. The next question is about silicon.
And that is simply, does that include silicon dioxide?

0:31:59.205,0:32:02.513
Effectively, when we say silicon
we're really talking about silicon metal.

0:32:03.488,0:32:08.416
And then if you're looking at some of the
I suppose the important forms of that

0:32:08.416,0:32:13.761
you really need polysilicon, especially for
for chips. So when we say silicon we mainly mean

0:32:13.761,0:32:21.104
silicon metal, and we separate that out
from silica which is industrial sand.

0:32:25.167,0:32:32.664
The next question is about copper. So it's quite a
long one so bear with me. The question reads...

0:32:32.664,0:32:36.608
Copper is not on the list since future supply
is the concern rather than current supply.

0:32:36.879,0:32:41.280
But isn't this one of the key reasons of this list,
to help promote investment in minerals

0:32:41.280,0:32:44.429
like copper to prevent supply shortages in the future?

0:32:44.429,0:32:47.624

Given the average project takes eight or nine years to build

0:32:47.624,0:32:50.779
then shouldn't there be a time component
within the model to account for this?

0:32:52.838,0:32:58.272
It's a great question. When we're doing a criticality
assessment we're using the last five years of data.

0:32:59.030,0:33:02.129
Now we do that because that's available and it's reliable.

0:33:02.129,0:33:06.771
If we're looking at trying to I suppose
undertake a future assessment

0:33:06.771,0:33:10.796
we'd have to both look at the demand side
as well as then the supply side.

0:33:10.796,0:33:16.918
Now there's a lot of uncertainty in how you build models around that.
I've done such things in the past on both sides.

0:33:17.406,0:33:22.270
So it's certainly possible. But it's not the way
the criticality assessments are normally done.

0:33:22.270,0:33:27.880
We look at where we're positioned now, we think about
some of the different sort of supply risks and we can see that

0:33:27.880,0:33:33.760
whether we're looking at the platinum group elements,
40% of world palladium for example

0:33:33.760,0:33:37.674

is actually coming from Russia, and that's not
subject to sanctions either. So...

0:33:37.891,0:33:44.213
I think there's different commodities will face different
risks, different both supply risks, different demand risks.

0:33:44.213,0:33:48.640
And so I think that's always important to be
able to sort of account for. So when we've looked

0:33:48.640,0:33:53.489
at all of this and we've spent a lot of time
in the current assessment trying to work out

0:33:53.489,0:34:00.520
how we could think about including a future derived
factor of... from our foresight studies so

0:34:00.520,0:34:05.993
where in our foresight studies we've looked across mainly
decarbonisation technologies such as solar panels,

0:34:05.993,0:34:11.820
wind turbines, electric vehicle batteries,
traction motors, and others.

0:34:12.632,0:34:17.682
And then looked at what that future growth
would be in the UK, after say 2050 to meet Net Zero.

0:34:17.682,0:34:24.230
And then what would be the material demand for that.
Now that leads us to around about 26 minerals

0:34:24.230,0:34:28.817
or materials that are incorporated into
all of those technologies,

0:34:28.817,0:34:31.594
but it means we're not doing that for the other 56.

0:34:32.028,0:34:37.280
So if we were starting to try and incorporate
future demand, or future supply into

0:34:37.280,0:34:44.283
the way we do criticality assessment, we'd have to
then also do the same exercise for the other 56.

0:34:44.608,0:34:48.781
And we don't have that,
and I don't know any group around the world that does.

0:34:49.160,0:34:54.319
There are certainly examples individually of whether
it's vanadium for example, and vanadium

0:34:54.319,0:34:58.397
is not part of our foresight studies.
But vanadium is expected to grow

0:34:58.885,0:35:03.781
quite rapidly in the near future in response to
the use of vanadium redox flow batteries.

0:35:04.539,0:35:10.382
So at the moment we felt that if we tried to incorporate a future
component into the way we're calculating criticality

0:35:10.382,0:35:16.232
we'd be potentially introducing more uncertainty
than you would actually add value.

0:35:16.232,0:35:21.274
And so for the moment we've looked at the potential

different scenarios, so if we look at lithium.

0:35:21.274,0:35:27.960
Lithium's going to increase somewhere between 10 and 20
fold by 2050 globally, to meet the demands for Net Zero.

0:35:27.960,0:35:31.278
So there's a very very big demand factor there for lithium.

0:35:31.278,0:35:34.907
Copper we need to increase you know
certainly by about 2040

0:35:34.907,0:35:38.991
by about 12% over our current trajectory of
where we are, where we're at with copper

0:35:39.400,0:35:45.660
so by the time we get to 2050 we're sitting at
about 2% above current sort of projections. So...

0:35:46.364,0:35:50.690
That I think is I think reasonable.
I think that given

0:35:50.690,0:35:54.772
the challenges there, and the uncertainties
and if we think about

0:35:55.151,0:36:01.243
when I say uncertainty, if we go back 5 years ago everyone
was expecting a huge increase in demand for cobalt

0:36:01.785,0:36:06.215
and we haven't seen that because lithium iron
phosphate batteries have come in

0:36:06.215,0:36:09.840

and they're providing just over 40% now
of EV batteries.

0:36:10.061,0:36:14.521
So I think there's these technology changes are
trying to predict them into the future

0:36:14.521,0:36:17.039
it's inherently uncertain and very very difficult.

0:36:17.364,0:36:23.467
So I think that's sort of why we've chosen sort of to look at
some specific materials like lithium, rare-earths and copper

0:36:23.467,0:36:29.256
in the report and analyse those
just on a case-by-case basis so

0:36:29.256,0:36:35.142
I certainly understand the question and the concerns
but I guess from a criticality assessment point of view

0:36:35.142,0:36:39.484
our methodology is based on the last 5 years
using that data that's out there

0:36:39.484,0:36:43.213
and saying where are we currently at
and thinking about what that means for the future.

0:36:43.213,0:36:44.698
So hopefully that helps.

0:36:48.219,0:36:50.746
Great, and you mentioned lithium iron phosphate

0:36:50.746,0:36:54.209
it's almost like you knew what the next question

that was coming up was going to be.

0:36:54.209,0:36:56.117
That's okay.

0:36:56.812,0:37:01.732
For batteries, given the rise of
lithium iron phosphate as a cathode
should Fe not be highlighted as well on the battery
material critical list, and the same for phosphorus?

0:37:07.866,0:37:13.566
Possibly, but at the moment the sort of the growth of
lithium iron phosphate batteries

0:37:13.566,0:37:17.966
is really only in the last two or three years
or maybe three or four years really.

0:37:17.966,0:37:21.783
So it's only just starting to appear
at the end of our 5-year period.

0:37:22.650,0:37:26.926
Now that may change in the future, and it's a
really good question in a way.

0:37:28.009,0:37:32.093
But if we're looking at you know phosphorus
I mean phosphorus is still critical

0:37:32.093,0:37:35.656
but the vast majority of phosphorus is used in agriculture

0:37:35.656,0:37:39.173
so fertiliser is the sort of predominant use there so...

0:37:39.502,0:37:44.880

Maybe lithium iron phosphate batteries will start to take up a
you know sort of a higher fraction of that but

0:37:46.018,0:37:49.793
So yeah, so there's other technologies
I guess that may emerge in the near future

0:37:49.793,0:37:54.267
and continue to sort of change the way that we
use different commodities, definitely.

0:37:56.217,0:37:58.287
Next question for your self, Pierre.

0:37:58.287,0:38:04.366
**Is there a list somewhere where the attendees can
access quantities and costs of imported critical minerals?**

0:38:06.466,0:38:11.872
Well obviously the list of critical raw material
changes every time we do new assessments.

0:38:11.872,0:38:17.817
But effectively the imported quantities
can be tracked using

0:38:18.359,0:38:22.990
BGS datasets of World Mineral Productions
and also following

0:38:23.640,0:38:30.000
some of the trade codes data that we are using in to
our assessment which are detail in the methodology

0:38:30.000,0:38:37.622
people can go on to tradecom data,
prodcom data and follow, try to track what their

0:38:37.622,0:38:43.502
specific commodity they are interested in, to how much
of it is imported or exported by various people.

0:38:44.043,0:38:51.600
Effectively, at the moment there is this desire
from higher instances, obviously from

0:38:51.600,0:38:57.527
the global group interested, global nation interested in
critical raw mineral policy to kind of create

0:38:57.527,0:39:03.802
this global visualisation of materials, where there are
imported stocks and flow, how they're moving.

0:39:04.343,0:39:08.880
But for some of the reasons we've highlighted before
in the fact that a lot of those raw material

0:39:08.880,0:39:15.920
effectively are not moving around necessarily in
their raw form, but into more transformed product

0:39:15.920,0:39:22.609
it is an extremely difficult task to create this
harmonised system across different countries.

0:39:22.880,0:39:28.720
Effectively lots of datasets, which are
publicly available are... can be consulted

0:39:28.720,0:39:32.223
to track import and export of critical raw material
in the UK, and elsewhere.

0:39:33.523,0:39:39.418
Just a quick point I'd add there as well is when you look at

the different supply disruptions across different materials

0:39:39.635,0:39:42.211
the links to price is not always obvious.

0:39:42.590,0:39:47.465
If you look at cobalt, the issues in the Congo
from the late 70s

0:39:47.465,0:39:52.600
caused a huge increase in price.
Rare-earths being exported from China in 2010

0:39:52.600,0:39:57.753
when there were really strong restrictions put in place
sent a huge increase in rare-earth prices.

0:39:58.120,0:40:04.361
In 2012 with the civil unrest in South Africa
with the Marikana incident

0:40:04.361,0:40:07.127
there was no impact on price
for platinum group elements at all.

0:40:07.560,0:40:12.640
So predicting the link between
supply disruption and price is not easy.

0:40:14.211,0:40:18.043
So I think there's certainly data sources
out there for various things but it's

0:40:18.802,0:40:22.040
putting it into models and assessments for the
future, that's always really difficult.

0:40:25.832,0:40:31.384

Great, thank you both. **The next question asks do you have any evidence that UK organisations are adapting, whether that be designs, manufacturing, stockholdings, etc. in response to evaluations like this?**

0:40:40.232,0:40:41.082
Yea, definitely.

0:40:41.082,0:40:46.495
I think what we're seeing is certainly opportunities,
whether it be the lithium landscape, whether we're looking at

0:40:47.637,0:40:50.701
you know groups, whether it be
the platinum groups sector,

0:40:51.080,0:40:53.880
aerospace sector, there are certainly
different examples of

0:40:55.126,0:41:00.000
organisations that are definitely looking at
the assessments we do, the lists we provide

0:41:00.000,0:41:05.520
and then proceeding accordingly.
Because as much as sometimes these are challenges

0:41:05.520,0:41:09.850
there're also opportunities so, and I think
that's sort of an important point to make.

0:41:12.342,0:41:17.784
Thank you Gavin. Next one for yourself, Pierre.
Have uncertainty bounds been considered within the criticality assessment?
Are there any minerals close to the threshold which would be considered critical

if uncertainty bounds are included?

0:41:27.360,0:41:33.920
Well this, a sensitivity analysis, which is what's
being called for here, is something we could do

0:41:33.920,0:41:41.141
effectively, and that could incorporate a lot of
different metrics, effectively we could assess

0:41:41.141,0:41:48.307
the quality, the certainty we have into the data itself
that we're using, and the way this is combined.

0:41:48.957,0:41:53.800
That needs to be compared across the panel
of all the candidate materials

0:41:53.800,0:41:57.287
and propagated through that.
So this is quite a complex exercise.

0:41:57.287,0:42:02.758
We are hoping to be able to do
some background calculation and check on this.

0:42:02.758,0:42:09.120
But effectively some of this sensitivity has been minimised
in terms of the confidence we have in the data

0:42:09.391,0:42:13.896
through the weightings that have been put in place
for each indicator.

0:42:14.329,0:42:19.394
Effectively some of the indicators
which are plotting very close to the threshold

0:42:19.394,0:42:23.960
are very important as well, and this is something
which we've talked about quite a lot

0:42:23.960,0:42:27.433
with our stakeholders, is that criticality
assessment, the plotting of effectively it

0:42:27.867,0:42:34.720
effectively it's a gradient. All the elements, all the materials
that we're evaluating, they all are important in

0:42:34.720,0:42:40.427
one stage or another, in some of the products that
we use throughout our industry, throughout our lives.

0:42:40.427,0:42:45.545
But for the sake of policy development,
investment, R&D, and so on

0:42:45.545,0:42:50.840
there is a necessity to put a threshold, to put a boundary
somewhere between those two, and to put a clear list

0:42:50.840,0:42:56.465
of what's critical, what will be the focus of the
Government and other industries in the near future.

0:42:57.440,0:43:01.757
It's also important to remind people that
this is an assessment that has been done

0:43:01.757,0:43:07.107
at this scale, and from the perspective of the
whole of the UK, for the manufacturing sector at least.

0:43:07.107,0:43:12.960
And effectively it doesn't mean that some of the materials

which are plotting below the threshold may not be critical

0:43:12.960,0:43:18.442
for a specific company, or a specific industry.
And as we've seen with the US

0:43:18.442,0:43:23.840
the Department of Energy has conducted their own
assessments and are highlighting different elements

0:43:23.840,0:43:29.480
because they are critical to them. This is an assessment
conducted at a scale for the whole economy of the UK

0:43:29.480,0:43:36.760
and therefore each company, each person, individual,
is encouraged really to have a deep deep down look

0:43:36.760,0:43:43.756
at their own supply chain, on the material they rely on,
to better tailor their response to such a drive.

0:43:47.060,0:43:51.280
Great. Thank you, Pierre. **Okay, next question.**
What is the difference between your
proposed vulnerability axis if compared to the
EU approach of considering economic importance?

0:43:58.340,0:44:00.552
Yeah, I'll let you take lead.

0:44:01.363,0:44:05.680
It's semantic really, it's very much the same thing, it's

0:44:06.493,0:44:11.160
a compilation of different... of similar
indicators really, that evaluate economy

0:44:11.160,0:44:17.200
the importance of an element within the
economy, whether you consider that has

0:44:17.200,0:44:21.640
the economic importance or effectively
the vulnerability of the economy would

0:44:21.640,0:44:25.902
there be a disruption, is roughly the same
thing. It's just two sides of the same coin.

0:44:28.520,0:44:33.760
Thanks Pierre. Gavin, next question for yourself.
Regarding better assessment of trade barriers
have you thought about how this may affect continuity
of the method and comparability through time?

0:44:38.523,0:44:43.311
Separately, will you look forward to implications
of likely changes to trade barriers?

0:44:45.369,0:44:50.120
Yeah, it's a great question because one of
the things I guess we always struggle with in

0:44:50.120,0:44:53.838
in looking at criticality is not only
is the landscape very dynamic

0:44:53.838,0:44:58.562
but we do try and evolve the methodology,
so keeping some sort of consistency there.

0:44:58.887,0:45:03.337
So we would hope that in future we would keep
the same three at the moment and add

0:45:03.337,0:45:06.095
say a fourth indicator for trade barriers there.

0:45:06.587,0:45:10.881
There's certainly some ways of doing that.
You can look at the frequency of different trade barriers

0:45:10.881,0:45:16.160
or you can look at the severity of them,
you could look at...

0:45:16.160,0:45:21.400
do we have trade agreements in place as well?
So the positive side. And that's something often that a

0:45:21.400,0:45:27.565
lot of the processes haven't taken into account.
So I think there's certainly possible ways to do that but

0:45:27.565,0:45:33.240
one of the issues I guess that certainly
we sort of struggled to work our way through

0:45:33.240,0:45:37.240
was how do you make this a predictive tool, how do
you make sure we're incorporating trade barriers

0:45:37.240,0:45:43.440
in a way that actually speaks to that level of
supply disruption, or that risk. And so it's a

0:45:43.440,0:45:47.809
it's a difficult thing, we haven't...
so that's why we haven't used it this time.

0:45:48.893,0:45:53.834
So I would hope in future it would just be fourth,
so you could easily go through and say

0:45:53.834,0:46:00.080
Here's the initial three indicators from this assessment
and in the next assessment, if you've got a fourth indicator

0:46:00.080,0:46:04.640
you would add for trade barriers. So I think that
would be a way I think we can start to get some

0:46:04.640,0:46:10.288
continuity there in the methodology. And then looking
at what the results mean, and so on as well.

0:46:12.942,0:46:19.261
Great thanks Gavin. **Pierre, could you explain
how supply chain has taken into account
tungsten for example, is used in nearly all cutting tools
but when those are imported into the UK
it's not tungsten which has been imported,
it's cutting tools for example?**

0:46:28.638,0:46:32.480
The example is tungsten here, specific
but it's not limited just to tungsten.

0:46:33.459,0:46:38.036
Effectively, so this... some of the form of those materials

0:46:38.036,0:46:42.360
effectively most of the import or export
is not as a raw material, as we said before

0:46:42.360,0:46:48.956
but in a transformed product. For the case of tungsten
effectively some of our trade codes that we are tracking

0:46:48.956,0:46:55.872
within the economic indicator for the UK economic

vulnerability, track the import and export of cutting tools

0:46:55.872,0:47:03.268
or machineries, and then we apply a ponderation
which consider the amount of tungsten which might be

0:47:03.972,0:47:07.623
contained within the products that are being
exported and imported.

0:47:07.623,0:47:12.695
And this is where some of the uncertainty
effectively arise, given we might be tracking

0:47:13.291,0:47:21.000
between three to four codes for some minor commodity
but up to 50 or more for some more important commodity

0:47:21.000,0:47:27.040
like iron and all the different types of steel.
So effectively, if we were to consider a different

0:47:27.040,0:47:31.880
slightly different example, all the different elements,
alloying elements which are incorporated

0:47:31.880,0:47:37.760
in a different type of steel, sometimes we know
there's only a handful of percent in them sometime

0:47:37.760,0:47:44.063
it can go up to five/six percent, so we can't incorporate
within the traded form of manufactured component

0:47:44.063,0:47:50.582
if we can evaluate them with certainty, we incorporate
those mass flow into the balance of import and export.

0:47:52.207,0:47:57.640
We could go on for each commodity
but it is effectively a very very difficult process

0:47:57.640,0:48:05.400
and we've gone through for each commodity a long
review of which code, which traded form we were

0:48:05.400,0:48:12.520
confident in being able to evaluate the amount of
tungsten, lithium, or any form, or any material that

0:48:12.520,0:48:15.000
we were considering for that specific assessment.

0:48:15.000,0:48:18.044
And we were trying to start from obviously the bottom

0:48:18.044,0:48:23.361
with all the raw ores and concentrate, different
mineral forms, different chemical compound.

0:48:23.361,0:48:29.760
And then you go into more transformed products
and when you're importing/exporting cars

0:48:29.760,0:48:36.720
well this is where this becomes very complicated
for instance, because of the demultiplication of

0:48:36.720,0:48:42.888
composition, average, size, group, make, and so on
and so on. So that applies across all the themes.

0:48:45.596,0:48:50.968
Thanks Pierre. Really good question.
Gavin, I've got a nice easy one for you.

0:48:51.293,0:48:54.265
Mike asks, will the slides be shared following the meeting?

0:48:55.403,0:49:03.165
Yea, we're happy to make the slides available.
I think just drop us an email either through the enquire at

0:49:03.165,0:49:07.261
at our website, our enquiries, or things like that.
Yeah happy to do that.

0:49:09.699,0:49:13.924
And then Diana asks, well first of all Diana starts
by saying thank you very much for this presentation.

0:49:13.924,0:49:15.458
Thank you Diana for joining us.

0:49:15.458,0:49:20.880
The question is, **what potential limitations exist
in the methodology that you use to determine the
current list of critical minerals for the UK?**

0:49:25.086,0:49:27.086
Probably a range of limitation. Firstly

0:49:28.224,0:49:32.440
we are reliant on the data and
we've gone through a lot of trade data and

0:49:32.440,0:49:36.262
you can certainly find examples where there's some
errors in trade data, so we have to use our own judgement

0:49:36.695,0:49:41.880
either to exclude such data, to correct it,
on what basis do we then correct it. And we've

0:49:41.880,0:49:47.160
certainly seen some examples there where we
feel we can justify corrections based on some

0:49:47.160,0:49:54.476
different sources. So there's certainly uncertainty there.
And sometimes trade codes change over time too

0:49:54.476,0:49:59.720
and sometimes you've got issues where
one trade code may have five or seven elements

0:49:59.720,0:50:05.440
actually listed within that trade code, and things
like germanium and vanadium and niobium

0:50:05.440,0:50:09.955
don't normally occur together geologically,
so the way they're mined and they're sourced

0:50:09.955,0:50:16.513
in terms of mining and refining is very very different.
So the trade codes don't really speak to that very well.

0:50:16.513,0:50:20.693
So then you've got to unpack all of that.
So there's certainly uncertainty on those sort of fronts.

0:50:21.126,0:50:25.000
For mining and refining data we're pretty confident
on that, where BGS has been

0:50:25.000,0:50:28.862
certainly a world leader in tracking mining and
refining for well over a century.

0:50:29.133,0:50:32.343
We've got one of the few groups globally

that does do that.

0:50:33.426,0:50:35.426
So that's where some of the main uncertainties are.

0:50:35.426,0:50:39.022
And then the other uncertainties, well
what threshold do we choose? And that's a choice.

0:50:39.943,0:50:46.935
For the weighting factors, we think we've got a good basis
on our weighting factors for both the supply risk and vulnerability

0:50:47.748,0:50:51.280
but that's also where there's some uncertainty.
And we... you could look at you know

0:50:51.280,0:50:55.672
trying different weighting factors and see
how things you know may plot differently.

0:50:57.026,0:51:00.473
We didn't feel that was useful, or adds value
in terms of this process here.

0:51:01.286,0:51:08.259
But if we chose the threshold of let's say six on our graph
we'd get very different list of critical minerals

0:51:08.259,0:51:14.387
that would obviously be a lot lot you know shorter.
If we chose three obviously it would be much bigger.

0:51:14.387,0:51:18.960
All right, so that choice of where we
put the threshold in the end is still

0:51:18.960,0:51:23.746

you know there's some uncertainty there as well.
We think we've got that threshold right

0:51:23.746,0:51:29.318
we think it's a good choice there and makes sense based
on the technologies that we see and the different demands

0:51:29.318,0:51:33.928
and links across to the various UK sectors.
So that's certainly where most of the uncertainty is.

0:51:35.770,0:51:39.040
Thanks Gavin. We've had a couple of questions
in about recycling

0:51:39.040,0:51:42.069
so I'm going to combine them together if that's okay.

0:51:44.511,0:51:48.852
Whilst the waiting downplays the use of recycling
this currently doesn't factor in...

0:51:48.852,0:51:52.600
Sorry, doesn't... sorry, let me start again.

0:51:52.600,0:51:56.520
Whilst the weighting downplays the use of recycling
this currently doesn't factor in recycling yield.

0:51:57.120,0:52:02.366
**How do you intend to improve the recycling data to give
a more representative picture of recycling extremes?**

0:52:02.745,0:52:08.527
**And the similar question was asking about how you plan to
incorporate more recycling data in future assessments?**

0:52:09.881,0:52:13.320

It's a great question and one of the challenges that

0:52:14.403,0:52:18.056
One: you need to think about how you calculate
recycling and how you actually quantitatively

0:52:18.489,0:52:25.280
estimate recycling. If we take an aluminium can,
we throw it away, it gets collected, and then that gets

0:52:25.280,0:52:30.760
sent off to recycling. So the proportion of
aluminium cans that are collected and sent off is

0:52:30.760,0:52:36.781
the traditional way we often think about recycling.
Now if we were to buy a new aluminium can

0:52:36.781,0:52:42.823
how much of that aluminium is actually recycled content?
And so that's the input recycled content

0:52:42.823,0:52:49.800
or recycling input rate, as it might be called. Now you then
have to think about aluminium is used not only in cans

0:52:49.800,0:52:55.462
it's used in alloys, in the aerospace sector, in
the automotive sector, and other things as well.

0:52:55.462,0:53:00.789
So then you've got to work out what are all of those
types of rates across all of those different end uses.

0:53:01.439,0:53:06.800
And when you're looking at the
at recycling data globally, no one has

0:53:07.396,0:53:12.680
perfect data calculating both collection rates,
recycled input rates, in some sectors there's

0:53:12.680,0:53:18.000
what we call closed-loop recycling that often
isn't accounted for by either a collection rate

0:53:18.000,0:53:23.183
estimate or a recycled input rate estimate
and that's where companies internally within a

0:53:23.183,0:53:28.840
within a manufacturing system may actually recycle
a lot of material, so you get scrap left over from the

0:53:28.840,0:53:32.919
the production process and that's fed back into
the start of the manufacturing process.

0:53:33.515,0:53:39.840
It doesn't even make it into say a particular product.
So there's a lot of complexity I guess in

0:53:39.840,0:53:45.627
in recycling and actually both the data that's out
there for things like recycled input rate

0:53:45.627,0:53:50.509
or the collection rate. And there's no consistency
around a lot of that globally either.

0:53:51.647,0:53:57.680
And that's largely because we, nowhere I think
has great data that actually properly maps and tracks

0:53:57.680,0:54:03.720
all of this across all commodities. So ideally

we'd want the same level of data quality across

0:54:03.720,0:54:08.600
all commodities. And so we have the same level
of sector use data, we have the same level of

0:54:08.600,0:54:16.160
quality around recycled input rates, collection rates,
and so on. And that's something that it's

0:54:16.160,0:54:20.840
broadly recognised, it was also recommended
recently by the Royal Academy of Engineering

0:54:20.840,0:54:26.760
in a report that said we need to have a dedicated
materials observatory that allows us to build the

0:54:26.760,0:54:30.920
datasets, so we're really calculating these
things and and understanding, not only just

0:54:30.920,0:54:36.520
the amount of stocks that exist in our systems
but what are the actual recycling rates, so we can

0:54:36.520,0:54:41.480
then plan for that. Because recycling, it can be a
much more important source of a lot of different

0:54:41.480,0:54:47.040
materials into the future. And certainly the IEA, the
International Energy Agency, recently released a

0:54:47.040,0:54:53.160
report looking at recycling of critical minerals.
And for copper we can help reduce that stress

0:54:53.160,0:55:00.000
on mine supply by improving the way we recycle copper.
And that's possible, what we need to look at is

0:55:00.000,0:55:05.615
some of the technology issues there, is there consumer
behaviour, are there price points we need to think about,

0:55:06.265,0:55:09.505
are there regulatory barriers or incentives
that we can look at.

0:55:09.884,0:55:13.570
All of those types of things we need to really think
about when we're talking about recycling.

0:55:13.570,0:55:16.766
And so it's a very difficult sort of area

0:55:17.687,0:55:20.560
but we know we need to make a lot more
progress in that and that's a certainly

0:55:20.560,0:55:25.560
an important way that we can help achieve
not only greater circularity, but also better

0:55:25.560,0:55:30.433
security of supply for things like a lot of our critical
minerals, and other important minerals as well.

0:55:32.850,0:55:37.235
Great. Thank you very much, Gavin.
So next question is for Pierre.

0:55:37.235,0:55:43.080
**Does the criticality assessment take into account
materials availability from UKs friends**

such as Australia and Canada,
thus modifying the criticality rating?

0:55:48.898,0:55:55.876
Right, so it's a good question. It's also fairly subtle
in the sense that it depends who you ask.

0:55:55.876,0:56:01.504
Who are the UKs friends and how rapidly
some of those friends might be changing.

0:56:01.504,0:56:05.729
There's no judgment about Australia, Canada
or any of the current ones but

0:56:05.729,0:56:09.978
it is quite a sensitive topic effectively to integrate.

0:56:09.978,0:56:15.000
The way we've gone about it nonetheless,
was to incorporate

0:56:15.000,0:56:19.498
variables on environmental responsibility,
sustainability and governance

0:56:19.498,0:56:25.520
in our indicators, so effectively we compiled
a range of

0:56:26.062,0:56:34.080
close to 50 plus indicators that captured those.
I think Gavin might have a slide or movie somewhere.

0:56:34.080,0:56:40.800
Yeah, effectively [thank you] on the production
concentration the share of production from each

0:56:40.800,0:56:47.880
country is weighted by what we call a compound
ESG score which captured to some extent some of

0:56:47.880,0:56:53.200
the value that the UK is championing
and how it's reflected in other centres of production.

0:56:53.200,0:57:01.680
So effectively this can be translated even further
even if the production concentration is high

0:57:01.680,0:57:08.920
if it comes from a country with a good ESG rating
the risk will be underated, slightly lower than

0:57:08.920,0:57:15.000
for a similar level of production concentration coming
from a country which has slightly lower standard.

0:57:15.000,0:57:20.760
So this is the way we've incorporated
this dimension, but effectively this also joins

0:57:20.760,0:57:25.844
back to the question of trade barriers whereby
we think mostly, quite commonly about China

0:57:25.844,0:57:32.540
putting export ban or trade barriers to some of the
raw materials they're processing or refining. But

0:57:33.569,0:57:38.176
it's important to consider that those trade barriers
come from both sides, most of the time.

0:57:38.555,0:57:43.440
China is also putting those trade barriers in response

to export control from the US, from the Netherlands,

0:57:43.440,0:57:50.920
from China, to their chips, microchip industry for
instance. And the EU Critical Raw Material Act is also

0:57:50.920,0:57:55.530
a trade barriers. The US Inflation Reduction Act
is a trade barrier.

0:57:55.909,0:58:01.250
So do we consider those are from friendly countries
or are those effectively additional trade barriers? This is

0:58:01.250,0:58:06.736
quite a difficult topic to simplify into a metric
which would be

0:58:06.736,0:58:11.667
on a set scale of 1 to 10, this is too subtle
to be incorporated that way.

0:58:13.128,0:58:17.680
And I think I'd add...
We felt that if we tried it would introduce a

0:58:17.680,0:58:23.520
lot more uncertainty and arguably more
subjectivity as well, and so that's why we felt

0:58:23.520,0:58:28.615
it's best to sort of keep it focused on a lot of these
sort of indicators we can see in front of us here.

0:58:28.615,0:58:33.848
Because that's where there is specific data that we
believe is of reasonable quality, or very high quality.

0:58:33.848,0:58:37.758
So that way it keeps our whole process
much more impartial and objective

0:58:37.758,0:58:43.436
and then policy can then respond to
those types of issues as policy should.

0:58:46.361,0:58:50.990
Thank you both. **So the next question
is asking about sodium and it reads...**

**Sodium is quite a surprise on this list, and you note it
is sodium metal / sodium carbonate that is the risk.
Given raw materials are available for this
is it just processing that's the limit?
How does this compare to something like titanium
which we cannot mine and refine in the UK
and a significant part of supply has
historically come from Russia?**

0:59:11.926,0:59:18.185
It's a good question. When you're looking at, let's sort of
flip forward, if we're looking at where sodium plots

0:59:18.564,0:59:22.247
so we can see... let me just find it here
for a second, where have we got sodium?

0:59:23.114,0:59:24.626
Sodium compounds, down the bottom here...

0:59:25.601,0:59:30.640
So it's certainly, in terms of economic value
I guess there's you know trade code for

0:59:30.640,0:59:33.236
the volumes of things like sodium carbonate

that are imported

0:59:33.236,0:59:38.111
there's also sodium nitrate that's used in fertilisers
so that links to agriculture

0:59:38.111,0:59:42.136
and sodium metal that's linked to some
chemical uses, and so on.

0:59:43.165,0:59:47.200
So when you're looking at that
that's where the trade data we're 100%

0:59:47.200,0:59:52.160
reliant on importing those specific forms.
Now when you're looking at titanium it's also used

0:59:52.160,0:59:57.089
in things like ferrotitanium and so on
and again we're looking at the sectors

0:59:57.089,1:00:03.600
but there's less sectors where we're using iron
so I guess the GVA is probably playing a factor there so

1:00:03.600,1:00:08.597
but they're not too different if you're looking at
the overall risk, criticality score for sodium

1:00:08.597,1:00:14.000
you're looking at about 4.3, where titanium you're
looking at about 5.1 there or so.

1:00:14.000,1:00:20.698
Oh sorry, 4.7. So not too far apart really
in terms of their overall sort of criticality score.

1:00:21.186,1:00:26.513
And that's really what we're looking at...
we're not trying to be sort of too absolute in a way

1:00:26.513,1:00:31.169
about the... about these, this is much more of a
relative assessment. It's certainly

1:00:31.169,1:00:36.640
when we're looking at specific sodium compounds
there's a lot of material that comes into the UK

1:00:36.640,1:00:41.743
and that's what the trade data shows. The uses
of that then link across, whether through GVA

1:00:41.743,1:00:47.160
into those various sectors, so that's sort of
where, why sodium plots where it does and

1:00:47.160,1:00:52.016
and effectively that's the same type of argument
we see with iron and others, and so

1:00:52.287,1:00:56.553
getting that equivalence there we think is really
really important as a way to make sure we understand

1:00:56.553,1:01:00.000
you know what's critical versus
important but not critical.

1:01:01.803,1:01:06.486
Thanks, Gavin. I'm just going to do a quick reminder,
we're now past the halfway point in the Q&A.

1:01:06.486,1:01:11.300
there's lots and lots of great questions still flooding in,

in fact we've got almost 60 still to be answered

1:01:11.300,1:01:14.075
which is fantastic,
it's great to see so much engagement.

1:01:14.075,1:01:17.651
We will do our best to answer these offline
the ones we can't get to.

1:01:17.651,1:01:22.681
So please do keep entering them in the chat.
The next question for yourself, Pierre.

1:01:22.681,1:01:27.283
During the presentation it was mentioned that quantum computing might be a future industry that will need to be taken into account.
Will this expand the number of materials that need to be assessed, for example rubidium?

1:01:35.404,1:01:39.089
Clearly yes. Quantum computing is

1:01:39.089,1:01:44.640
as much as development of all the future information,
communication technology, development of AI

1:01:44.640,1:01:50.760
is going to put massive strain on a range of very
very minor elements that are going to be essential

1:01:50.760,1:01:57.380
for the development of these technologies to use in
microchips, the development of the data centers which are

1:01:57.597,1:02:04.221
really underpinning the development of the processing

power of these new technologies, so effectively

1:02:04.654,1:02:10.713
what we're recommending is to do a deep dive
on these technologies and investigate

1:02:10.713,1:02:15.000
where those materials are currently known to occur,
where they are being produced,

1:02:15.349,1:02:19.412
where are the centres of production in terms of
the manufacturing sectors

1:02:19.412,1:02:21.126
where all the microchips are being produced?

1:02:21.668,1:02:25.773
Where is all the high purity silicon coming from,
gallium, germanium, and so on?

1:02:25.773,1:02:29.360
So there is a very large picture that need
to be gathered and this is very similar to some

1:02:29.360,1:02:34.960
of the foresights we're conducting at the moment
and some of them are to be published very soon.

1:02:34.960,1:02:38.146
So yes, this is something we would really
like to be doing.

1:02:38.146,1:02:42.367
Rubidium effectively will need to be investigated
in its own right.

1:02:43.292,1:02:48.618

Some other comments I'd add there as well and it's
one of the challenges we have. If we think of iron

1:02:48.618,1:02:52.078
there's something like three and a half thousand
alloys of iron.

1:02:52.078,1:02:56.703
Now we're looking at the totality of all of that
when you're looking at quantum computing

1:02:56.703,1:03:00.249
you're not just looking at different materials
like high purity silicon

1:03:00.520,1:03:03.837
but you're also looking at isotopically pure materials.

1:03:04.312,1:03:09.392
And that's a type of you know depth I guess
in looking at the material inputs that

1:03:09.392,1:03:15.000
is extremely rarely done, in fact I don't think
I know of an example of a criticality assessment

1:03:15.279,1:03:18.157
that has actually included isotopic purity.

1:03:19.323,1:03:26.080
And we could look at specific forms, the USDRE
obviously lists electrical-grade steel for specifically

1:03:26.080,1:03:30.973
for energy technology, so there's certain examples
where certain materials do get looked at.

1:03:31.407,1:03:35.626

But again we need to look at that I guess and
some ways that would, as Pierre sort of said as well

1:03:35.626,1:03:39.218
it's a different approach, you would look at that
more as a deep dive into the technology

1:03:39.218,1:03:46.184
and then look at all the... whether it's high purity
materials or the isotopic purity materials

1:03:47.701,1:03:52.800
So there's some other questions around things like
quantum that no one's really started looking at yet so

1:03:52.800,1:03:55.720
that's why we're really keen to do that in the
near future, because we think it'll be a great

1:03:57.038,1:04:02.280
a great opportunity for the UK to make sure
we're at the forefront of what what's happening

1:04:02.280,1:04:06.502
with quantum, but also to make sure we really
understand what's, what the material basis of it is.

1:04:09.102,1:04:13.200
Thanks, Gavin. Okay, we've got another couple
of questions that are related and this time it's in

1:04:13.200,1:04:18.104
regards to next steps in the role of the Government
or how this will interface with the Government's plans.

1:04:19.350,1:04:22.376
So the question asks,
what happens now with this assessment?

Does that mean this is now the UK's critical mineral list?

And when and what does this mean for
the UK Government's actions in these areas?

1:04:30.827,1:04:35.280
The following question, which is related, goes on

how does the UK Government engage with specific
countries about diplomatic partnerships

related to this assessment?

And how do we ensure that imports and critical minerals,
and which critical minerals we kind of focus on?

1:04:47.348,1:04:50.672
What's the Government's process of
identifying state partners?

1:04:52.568,1:04:58.040
I think policies obviously, that's the role of DBT
and we have our various other arms

1:04:58.040,1:05:03.215
of the UK Government that I suppose develop policy
and then implement policy.

1:05:04.623,1:05:09.639
That policy is informed by our analysis
and what we've identified as critical minerals.

1:05:10.072,1:05:15.000
I guess the next steps for the UK Government
would be actually the Critical Mineral Strategy.

1:05:15.000,1:05:20.110

So a new strategy that takes into account
our criticality assessment.

1:05:20.110,1:05:24.880
But we know from the work that's been going on, there
is a lot of work going into different trade relationships

1:05:24.880,1:05:31.958
looking at different countries and you know, what
does the UK need, what can other countries provide?

1:05:31.958,1:05:34.740
So there's certainly a lot of work going into all of that.

1:05:34.740,1:05:39.811
And that's where, whether it's DBT, whether it's the
Foreign and Commonwealth Development Office.

1:05:40.678,1:05:45.995
And all the other parts across the UK Government
that are involved with all of that. And so

1:05:45.995,1:05:52.080
And that's something we're looking forward to contributing
to. One of the things I guess that we're certainly

1:05:52.080,1:05:57.400
we do is actually set international collaboration
and so that's something that BGS more broadly has

1:05:57.400,1:06:02.253
been doing for a very long time.
My home country of Australia of course

1:06:02.253,1:06:07.222
the geological surveys were set up by the British
Geological Survey back nearly two centuries ago.

1:06:07.222,1:06:12.600
So a lot of that international work is something
that has been bread and butter not only just from

1:06:12.600,1:06:16.822
the Geological Survey point of view but also I
suppose international trade and and so on as well.

1:06:16.822,1:06:20.480
So I guess that's some of the next steps
but we're certainly looking forward to um a lot

1:06:20.480,1:06:24.520
of that international collaboration because that
certainly is what's needed because there's

1:06:24.520,1:06:28.440
some metals and minerals as much as there's
prospectivity in the UK for some things and

1:06:28.440,1:06:32.396
and prospects for things like lithium and tungsten
to be produced in the UK

1:06:32.884,1:06:36.994
we'll still need our international trade partners
to make sure we're supplying a whole range of

1:06:36.994,1:06:39.995
other critical minerals and other important
minerals as well.

1:06:41.995,1:06:46.625
Thank you, Gavin. Okay Pierre, next one for yourself.
Over time would it be reasonable to expect

that the criticality score of certain critical minerals
could be reduced due to interventions by Government

and related agencies including financing, regulatory changes and innovation?

1:06:57.938,1:07:01.954
Well effectively this is the ultimate goal to some extent.

1:07:02.225,1:07:09.000
The criticality assessment really is a risk assessment.
We know we identify a list of materials which are at

1:07:09.000,1:07:14.187
high risk of supply disruption and would have
a high impact on the economy of the UK.

1:07:15.217,1:07:21.040
The goal of that assessment is to flag really those
material to the Government but also to all the different

1:07:21.040,1:07:26.520
industries that make use of those materials
and for them to take actions into looking into their

1:07:26.520,1:07:33.929
supply chain, or how to reduce the risk associated
with supply, or potentially try to diversify.

1:07:33.929,1:07:40.400
That can take many many different aspects, that can be
improving domestic production, so if this is the case

1:07:40.400,1:07:44.840
we have a lot of support from Government
in doing so at the moment with lithium, tungsten

1:07:44.840,1:07:52.480
and other commodities. This could be enhancing
trade relationship with major producing countries

1:07:52.480,1:08:01.040
as we've said earlier. But effectively as
we see more and more of those intervention

1:08:01.040,1:08:08.283
happening effectively that should weigh onto the
quantification of the indicators that we use

1:08:08.283,1:08:12.708
as a reduction of risk proportionally.
And effectively ideally

1:08:13.718,1:08:17.976
we're flagging those which are at risk now
and maybe in 20 years or in 10 years

1:08:17.976,1:08:23.100
hopefully we'll see some of those elements
slightly going down, whether they will be

1:08:23.100,1:08:28.400
delisted as critical is another question.
What's the impact in terms

1:08:28.400,1:08:33.920
of continuous funding and support for the industry
if we, if this is achieved through domestic supply

1:08:33.920,1:08:36.329
is also something that's needed to talk about.

1:08:36.329,1:08:41.450
But those are a question in balance to... for the future,
for the Government and future policies.

1:08:42.506,1:08:46.820
Yeah, I think a good example for that is actually

fluorine or the mineral fluorspar

1:08:46.820,1:08:50.777
which is used to produce sort of hydrofluoric acid
and so on.

1:08:50.777,1:08:56.440
So at the moment it plots well to the left
in terms of its economic vulnerability for the UK

1:08:56.440,1:09:02.240
because under the five years we've analysed
the UK was a strong producer. Now last year

1:09:02.240,1:09:09.181
that stopped. So if we were to use a current
position in fluorspar which is zero production

1:09:09.181,1:09:15.000
and therefore 100% net import reliant, that would
change the economic vulnerability across to five

1:09:15.000,1:09:19.367
and it would plot above the, above the
criticality threshold. So I think...

1:09:19.367,1:09:24.355
If we think about that in reverse, and so what actually
if we reinstated fluorspar mining just as a you know

1:09:24.680,1:09:29.880
hypothetical example, then yeah, it would shift
to the left so... and that's a good thing because

1:09:29.880,1:09:34.571
we would be achieving that sort of resilience of
supply, that security of supply

1:09:34.571,1:09:40.419
to support the UK industries and the various
environmental social and economic goals that we have.

1:09:44.265,1:09:46.853
Next question.

1:09:48.370,1:09:52.332
I think for yourself, Gavin.
Has there been any recalculation of the criticality

since the workshop at the end of September?
If so why, and what has changed?

1:09:58.146,1:10:03.322
We've always gone through, we've gone through
a very rigorous QA/QC process

1:10:03.322,1:10:07.360
and so certainly as that's evolved
there's certainly been some changes and

1:10:07.360,1:10:13.467
and that's part of the normal process in science.
You build your datasets, you do your quality control checks

1:10:13.467,1:10:18.688
and certainly there's been, yeah, some changes
between as the process has evolved, so certainly.

1:10:25.676,1:10:30.721
A question I can actually answer here, and that is
how can we access the recording of the meeting?

1:10:30.721,1:10:36.500
So the recording will... we'll do some captions so it's
accessible, and that will be made available next week

1:10:36.500,1:10:42.889
through the website. I think there's an event page
on the BGS website with all the details

1:10:42.889,1:10:47.955
we'll put a YouTube link on there, and we'll also
link to it from the CMIC website as well.

1:10:52.018,1:10:57.202
Okay, a question for yourself, Pierre.
Substitution has not been mentioned very much

1:10:57.202,1:11:02.468
what potential does the team feel for material substitution to alleviate the criticality of elements or indeed substitution of the products that incorporate critical minerals?

1:11:06.830,1:11:10.451
Right so this is something we effectively

1:11:11.589,1:11:15.322
decided to discard, discount from our assessment

1:11:15.322,1:11:18.862
this time compared to previous years
because effectively

1:11:19.729,1:11:30.440
there is a lot of doubt that this indicator actually
usually bring forward added value to lowering

1:11:30.440,1:11:35.886
the risk on the elements that are substituted.
Effectively most of the time if we are

1:11:36.590,1:11:43.720
aiming for maintaining the performance of the

the material that we we're using, the component

1:11:43.720,1:11:49.287
that we're trying to develop, and substituting
an element for something which provide

1:11:49.287,1:11:54.600
similar performance for a similar cost, most
of the time we are substituting a critical metals

1:11:54.600,1:12:02.380
with another critical metals. And effectively this is also
industry dependent, application dependent and

1:12:02.380,1:12:09.587
make the assessment of the overall
substitutability indicator very complicated.

1:12:10.021,1:12:17.040
We can take the example of LFP batteries versus
NMC type batteries where effectively this is a successful

1:12:17.040,1:12:25.720
substitution, but it has definitely drastically reduced
criticality in other form, in other indicator.

1:12:25.720,1:12:34.093
Effectively the substitution of cobalt to... by iron and
phosphate has effectively reduced the demand for cobalt

1:12:34.093,1:12:41.342
and this is picked up in other dynamic indicators. To
some extent this is incorporated in an indirect way

1:12:41.667,1:12:47.650
but it's a notion which is very complex to evaluate
in such an assessment.

1:12:48.733,1:12:55.858
I'd add there as well, there are examples as we sort of
pointed to with cobalt, and the DRC, and the late 70s

1:12:55.858,1:13:00.520
and the aerospace sector substituted.
It's not always easy to predict

1:13:00.520,1:13:05.440
it's not always easy to actually make happen
and so there's a lot of uncertainty about

1:13:05.440,1:13:11.667
how successful you could be with you know substitution.
And also we know that if you substitute

1:13:11.667,1:13:16.839
you're often doing so with affecting the performance
and so you can't achieve the sort of same quality

1:13:16.839,1:13:21.958
of product or service that you're actually
that that material is used for in the first place.

1:13:21.958,1:13:27.329
So I think there's a lot of uncertainty
as to how accurate substitution

1:13:27.329,1:13:32.048
can really help in a criticality assessment.
Which is why we've chosen to not include it this time.

1:13:35.948,1:13:41.432
The next question is a follow-up to a question that was
answered earlier, and that was in regards to where

1:13:41.432,1:13:45.321
we're advising the Government, that this

should be reviewed every three to five years.

1:13:45.863,1:13:49.544
The question asked what's the justification for this when we have spent a long time in the Q&A and the presentation talking about the dynamic nature of the data?

1:13:55.101,1:14:00.235
Yeah, it's a great question. There's a lot of work, it's taken us several months to be able to

1:14:00.235,1:14:04.886
work through all of the data, pull this together and deliver this project.

1:14:05.482,1:14:10.280
which is why we think there's a need to be able to do a rapid response. So if we take a particular commodity

1:14:10.280,1:14:16.478
there's a supply disruption of some sort, we can go through and actually do that very very quickly

1:14:16.478,1:14:20.050
so we don't have to wait another 3 years to be able to look at that

1:14:20.050,1:14:22.399
but then we're only looking at that particular commodity.

1:14:23.753,1:14:28.489
That's okay, it's a rapid response, it's not meant to be a full comprehensive criticality assessment.

1:14:29.085,1:14:34.076
So I think there's a balance there we need to be able to strike between doing a comprehensive assessment of

1:14:34.076,1:14:36.860
all materials and where their sort of current position is

1:14:37.239,1:14:43.910
versus being able to do a rapid response. There's a
trade issue or there's been an environmental problem

1:14:43.910,1:14:48.578
or a social issue for example that's impacted supply

1:14:48.578,1:14:53.953
and therefore we can go in, update some of the data
and see what's changed between say if we did this

1:14:53.953,1:15:00.884
in a year's time for let's say there was
restrictions around the global flow of tungsten

1:15:01.480,1:15:05.503
then we could look at the data, update that, and say
how much has changed in some of the indicators and

1:15:05.503,1:15:11.080
and what does that mean. So how much more
critical might tungsten be in that sort of scenario.

1:15:11.080,1:15:15.619
and so I think that's the sort of... we've got to
be able to balance off, so there's a lot of work

1:15:15.619,1:15:19.472
and going through, there's hundreds and
hundreds of trade codes to go through

1:15:19.472,1:15:23.060
we've got 82 commodities to sort of
pull together the data for

1:15:23.060,1:15:28.636
and get all of that sort of synthesized into the
spreadsheet so we can do the sort of calculations

1:15:28.636,1:15:33.205
and pull that together. So I think that's sort of why
these full assessments are only done

1:15:33.205,1:15:38.695
roughly every two or three years, and that's the same
in the EU as it is elsewhere, it's you know

1:15:39.020,1:15:42.397
the legal mandate in the US as well is for these
things to be done every three years.

1:15:43.860,1:15:48.143
But I think there's a role there to be able to say
there's an opportunity to develop

1:15:48.143,1:15:50.960
a methodology that is a more rapid response.

1:15:50.960,1:15:55.190
And so that way we can go in and analyse a particular
commodity and we can do that much more

1:15:55.190,1:16:02.099
quickly and efficiently, to then provide advice on
what are some of the options or the issues there.

1:16:05.132,1:16:09.978
Great. Thanks, Gavin.
Pierre, the next one for yourself.

1:16:09.978,1:16:15.000

How much have you quantified the potential availability of critical raw materials in legacy waste in the UK?

1:16:15.000,1:16:21.755
For example in coal tips, mining waste dumps, PFA,
coal fired power stations, metal refining slags,

1:16:21.755,1:16:24.920
water treatment, work sludges, and so on.

1:16:27.209,1:16:34.295
We haven't been able to do this assessment
throughout the whole of the products obviously

1:16:34.295,1:16:41.733
that we evaluated, some of those have well defined
codes for waste and scraps in the trade data and

1:16:42.275,1:16:49.222
effectively it highlights some of the major
I would qualify this as major leakage of material

1:16:49.222,1:16:55.832
that the UK is producing, or is not dealing with
notably for copper or for tungsten.

1:16:55.832,1:17:02.440
Effectively tungsten is the third largest world
exporter of tungsten in the... in the world

1:17:02.440,1:17:10.880
and this is due mostly into various forms, but
there is definite potential for valorising

1:17:10.880,1:17:18.904
secondary sources as a source of material for
extraction effectively, coal fly ash is a good example

1:17:18.904,1:17:24.256
and we notably touching on this subject
very briefly into the report saying that

1:17:24.256,1:17:32.240
stopping coal fired power station in the UK,
whilst it's a good thing for reducing our CO2 emission

1:17:32.240,1:17:38.320
also therefore reduce the stocks of available
coal fly ash from which we could use, derive some

1:17:38.320,1:17:42.432
other elements or make use in cement and other
lightweight construction material.

1:17:42.432,1:17:51.400
So there's always a trade-off between everything. As to
the mine waste in the UK, the historical mine wastes

1:17:51.400,1:18:00.040
represent fairly small quantities, small volumes
that would justify really a very strong

1:18:00.040,1:18:07.360
reinvestigation of some of the old stock piles.
But effectively there is another issue associated

1:18:07.360,1:18:13.960
with those historical exploitation areas
that most of them are currently heritage site or

1:18:13.960,1:18:20.040
located within areas of natural protection and so on
so effectively there is this dimension which is

1:18:20.040,1:18:27.240
part of the history of the UK and we not really

have stock pile enough of the volume because

1:18:27.240,1:18:33.400
this exploitation happened a century ago or more
than that, sometime to really justify the volume

1:18:33.400,1:18:36.430
an industry would currently look at valorising.

1:18:37.568,1:18:41.681
Another point to sort of add in there as well
is that when you're looking at mine waste

1:18:42.494,1:18:45.898
sometimes you can go in, and there are certainly
many examples

1:18:45.898,1:18:49.683
in my research in Australia and other colleagues
there as well, where you can go in

1:18:49.683,1:18:55.436
a site was processed for gold and there may be
bismuth or tellurium in the tailings there for example.

1:18:55.436,1:19:00.503
So there's certainly examples where that's possible.
But you have to have the data to be able to do that.

1:19:00.503,1:19:05.220
And there are other sites as well where you
may not go in just to clean up a site.

1:19:05.220,1:19:09.952
If you look in Australia, there's examples where
you would go in, if you look at the Mount Lyell

1:19:09.952,1:19:15.640

and the Mount Morgan mines with gold and
copper, you go in and reprocess those tailings

1:19:15.640,1:19:19.117
with one of the main aims of actually cleaning
them up and actually remediating them.

1:19:19.117,1:19:24.126
Now you reprocess the tailings and you maybe
treat the acid mine waters to recover

1:19:24.126,1:19:27.657
different elements or critical minerals for example.

1:19:28.361,1:19:32.094
And that may be how you justify some of the revenue
for the remediation.

1:19:32.094,1:19:37.633
But sometimes there's other justifications as well
and I think, certainly as Pierre sort of said

1:19:37.633,1:19:43.216
a lot of the mining in the UK was much more historic,
much older era, in a much smaller scale.

1:19:43.216,1:19:48.265
But doesn't mean it's not worth looking at and it's
something that we think is certainly worth looking at

1:19:48.265,1:19:52.142
in more detail.
But at the moment I think the

1:19:52.142,1:19:58.118
the issues really are understanding some of the
technologies and trade flows, that's sort of where the

1:19:58.118,1:20:03.481
I suppose the, that opportunity around the
secondary trade flows is really important.

1:20:04.944,1:20:08.325
Thanks, Gavin.
Another one of the rare questions that I can answer.

1:20:08.325,1:20:13.200
So someone's asking about the next critical minerals
conference to be held at Keyworth

1:20:13.200,1:20:15.286
and where they can get more information.

1:20:15.665,1:20:20.116
Invites and details are to follow
but if you would like to express an interest

1:20:20.116,1:20:24.720
you can simply email the enquiries
at BGS mailbox that Gavin mentioned earlier

1:20:24.720,1:20:29.640
or there's also the BGS corporate comms inbox
which is on your invite, your Zoom invite and reminder

1:20:29.640,1:20:35.157
for this conference, and we'll pass your
interest onto the team to get further details.

1:20:35.807,1:20:41.208
Next question for yourself, Pierre. **How can deep sea
mining play a role in supply chain development and growth?**

1:20:43.699,1:20:50.488
So deep sea mining is a very delicate subject
quite hotly debated at the moment.

1:20:50.488,1:20:59.382
Effectively there's well characterised mineral resources
potential in the oceans, some of them occurs within

1:20:59.382,1:21:04.005
the exclusive zone of some countries, some are
within the high seas and therefore fall under the

1:21:04.005,1:21:10.409
the regulation of the United States, the United
Nations, sorry. Effectively deep sea mining

1:21:10.409,1:21:15.000
we could make the parallel with space mining
for that matter

1:21:15.000,1:21:18.273
deep sea mining is a bit further ahead
in terms of potential development.

1:21:18.544,1:21:24.513
Would be a way of diversifying supply chain
and creating new centres of production.

1:21:24.513,1:21:29.505
Effectively there are some well-known advantages
to deep sea mining, but also a lot of

1:21:29.505,1:21:35.958
hurdles around stewardship,
economy reparation between countries

1:21:35.958,1:21:38.873
as well as obviously environmental consideration around

1:21:39.090,1:21:43.441
well, exploiting this new frontier potentially of mining.

1:21:44.037,1:21:50.262
There have been obviously some exploitation already
happening in some location, notably in the Red Sea

1:21:50.262,1:21:57.944
back into the 70s/80s. There has been, there is
already a history of deep sea mining happening.

1:21:57.944,1:22:02.594
Some nations are actively looking for developing
potentially this industry

1:22:02.811,1:22:08.992
other are positioning themselves for a moratorium
to wait until we have more information

1:22:08.992,1:22:15.623
to be able to properly take a decision.
So it would be, it is an opportunity

1:22:15.623,1:22:21.560
and I think the greatest opportunity that we have
is effectively properly regulating an industry

1:22:21.560,1:22:29.600
before it actually starts any activity. So there,
if done right this could be a good opportunity but

1:22:29.600,1:22:38.039
we need to make sure that everybody agrees
in this consensus, on what defines right effectively.

1:22:40.966,1:22:43.893
Thanks, Pierre. And another one I think for yourself.

1:22:43.997,1:22:47.960
As most of these critical minerals are produced

using extractive metallurgy
has the criticality of the reagents required
the extraction...
required in the extraction
be considered alongside the minerals themselves?

1:22:56.869,1:22:58.225
Right...

1:22:59.413,1:23:02.557
That's a very interesting one from a
methodology perspective .

1:23:02.557,1:23:09.580
Effectively we've assessed all the industrial sectors
in which each candidate material contribute.

1:23:09.580,1:23:17.114
So effectively if one is used in the processing
or the chemical industry, the refining process

1:23:17.710,1:23:22.192
it's the contribution of that element to that stage
of the industry, but effectively

1:23:22.517,1:23:28.185
it's very difficult to evaluate how much one element
contributes to the production, or refining of

1:23:28.185,1:23:32.193
another element, and whether that contributes
to its criticality.

1:23:32.193,1:23:37.812
This is an interesting point, and effectively something
eventually to consider for future assessments

1:23:37.812,1:23:45.000

see how we can potentially incorporate that, include it,
which would effectively demultiply potential criticality.

1:23:46.029,1:23:50.631
I think one comment I'd add there as well is
we can see some of these issues coming.

1:23:50.631,1:23:57.856
The reduction, the gradual reduction in fossil fuel use
will reduce the availability of sulphur.

1:23:58.127,1:24:04.367
Now sulphur is used to make sulphuric acid
which is an input to a huge array of different industries

1:24:04.367,1:24:08.443
whether it's chemical or extractive metallurgy
and many others

1:24:08.443,1:24:13.515
and so in in some parts of the world you know
sulphuric acid is actually a really critical commodity.

1:24:13.732,1:24:18.920
Regardless of whether one calls sulphur a critical
mineral or not, it's actually crucial for a lot of industries

1:24:18.920,1:24:23.113
and they're always worried about maintaining their
secure supply chains.

1:24:23.113,1:24:26.634
So I think we can see some these issues coming
but from a methodological point of view

1:24:26.634,1:24:31.169
as sort of Pierre was sort of talking through
we allocate to end use, we don't go through the start.

1:24:31.169,1:24:34.458
And if we're looking at the start of things
we'd have to start factoring in the

1:24:34.458,1:24:39.223
the platinum that's used in petroleum refining
and start to go through a huge variety of

1:24:39.223,1:24:44.546
the processes that are used to produce every
material and product that we make.

1:24:45.000,1:24:51.823
That level of data is often hard to validate like the
total amount of chemicals, the total different reagents

1:24:51.823,1:24:57.485
all of these things that sort of help to achieve a product
by itself, whether it's a phone, a car, or whatever

1:24:58.568,1:25:00.844
That would be an enormous task, but it's...

1:25:01.657,1:25:03.140
Hopefully that helps.

1:25:05.178,1:25:07.755
Okay, we're on to the last couple of questions.

1:25:08.730,1:25:14.738
So the next one's asking about uranium, which the question
highlights as a cornerstone element of the nuclear industry.

1:25:15.000,1:25:19.800
They would like to know for what reason
did it fail to meet the threshold for criticality?

1:25:19.800,1:25:21.984
And what factors influenced this outcome?

1:25:23.284,1:25:24.770
I'm happy to take lead on that one.

1:25:24.770,1:25:28.628
If you look at uranium there's a significant fraction
that comes from Kazakhstan

1:25:28.887,1:25:35.568
but you also have a significant amount coming
from Canada, Australia and other countries that

1:25:35.839,1:25:39.562
score reasonably, to very highly
on things like their ESG ranking.

1:25:39.995,1:25:45.000
So from a global supply risk point of view
uranium is fairly widely supplied

1:25:45.000,1:25:49.387
and therefore its supply risk is lower than other
things such as rare-earth elements which are

1:25:49.387,1:25:55.659
mostly coming from China, or more recently Myanmar
where the ESG score are obviously much poorer.

1:25:56.255,1:26:00.818
So when you're looking at the economic vulnerability
it does have a single use and that attracts to

1:26:00.818,1:26:04.704
electricity production in the UK
and so when you go through those sorts of numbers

1:26:04.704,1:26:08.183
uranium plots where it does
so that's sort of where it is.

1:26:08.183,1:26:11.240
Now that's not to say it may,
it won't change in the future

1:26:11.240,1:26:15.832
I think there's certainly some dynamics
Australia is no longer a bigger producer

1:26:15.832,1:26:21.662
the Ranger uranium mine is now closed
so we'll see what happens in the uranium space but

1:26:22.204,1:26:24.948
that's the reasons why uranium plots were does.

1:26:26.627,1:26:28.194
Thanks, Gavin.

1:26:28.415,1:26:33.861
Okay the next question asks about the noble gases
and notes that only helium was considered.

1:26:34.186,1:26:39.826
**So is there a reason why the other noble gases
weren't considered in this assessment?**

1:26:41.288,1:26:45.473
Happy to take the lead on that one.
Helium is almost entirely a byproduct

1:26:45.473,1:26:48.952
mostly petroleum refining

1:26:49.319,1:26:54.960

it's currently extracted as a raw material
others are actually extracted from our atmosphere

1:26:54.960,1:27:00.000
things like argon, so there's no concerns about
I suppose resource depletion or anything else

1:27:00.000,1:27:06.724
like that, it's basically is produced as a
factory as a processed product really so

1:27:06.995,1:27:10.846
so from a raw material perspective
helium is worth looking at

1:27:10.846,1:27:13.225
and helium has some very particular uses as well.

1:27:14.313,1:27:17.528
Especially in some medical technologies
such as MRIs and so on.

1:27:17.745,1:27:24.127
So helium is worth including, but we didn't feel
the need to look at things like argon because

1:27:25.156,1:27:30.368
it's extracted from our atmosphere
and there's no constraint on that per se.

1:27:32.859,1:27:38.493
Thanks, Gavin. We're at half past and I'd like
to finish with one of my own questions, if I may?

1:27:39.360,1:27:42.643
And I'll start with yourself, Pierre,
but it's the same question to both of you.

1:27:43.077,1:27:48.030
Given that a lot of the questions, and in your
presentation itself, you said this is a dynamic

1:27:48.030,1:27:51.583
you know, it's always evolving in terms of
criticality and needs

1:27:52.017,1:27:56.176
what minerals have you got your eye on,
or what do you think could be developing
or interesting stories over the years ahead?
And why?

1:28:01.788,1:28:03.220
[Laughs]

1:28:03.868,1:28:09.289
Well that is quite a loaded question!
Sorry.

1:28:09.560,1:28:11.647
I think effectively there is...

1:28:12.622,1:28:17.523
having worked on these problematic
over the last three years now

1:28:17.523,1:28:20.480
I was seeing how rapidly the
landscape is evolving so

1:28:20.480,1:28:26.930
effectively there might be a need to rethink the way
we do those criticality assessment and build on

1:28:26.930,1:28:32.520
all the data analysis, the databases, the way we're

doing those analysis, and trying to improve them

1:28:32.520,1:28:39.320
so that they can be updated more rapidly.
So those are potential projects we're looking into

1:28:39.320,1:28:45.743
trying to develop for the next few years
effectively how to build up a system that

1:28:45.743,1:28:51.848
into which we can rapidly input, that can be interactive
potentially for stakeholders to consult in real time.

1:28:53.744,1:28:59.280
Because our job is also to provide like
good quality data onto which people can rely

1:28:59.280,1:29:05.071
there is a need to explore really the sensitivity and
how responsive we can be when some of the data

1:29:05.071,1:29:09.726
is very much a lot of noise around different things
and we need to see the long-term trends.

1:29:11.080,1:29:16.145
There is a lot of work to be done on those case.
As to my, some of my favourite topics, well...

1:29:16.741,1:29:24.040
I think batteries obviously are going to be one the
the drives for the future, I really look forward to them.

1:29:25.369,1:29:28.365
I see what you did with drive there
as well, nicely done!

1:29:31.290,1:29:36.124
Yeah, I think I'd add... you know copper is going to be
fascinating to see how that evolves, in many ways.

1:29:36.124,1:29:41.840
There are real issues with copper and that's not
that we can't see what's... where those issues are

1:29:41.840,1:29:46.383
they're environmental, they're social, they're
governance, they're not geological

1:29:46.383,1:29:51.240
we know there's plenty of copper out there that could
be developed, it's a matter of how we develop them

1:29:51.240,1:29:54.496
and the terms and conditions I guess,
so copper is certainly one to look at.

1:29:54.767,1:29:59.164
But I love the whole periodic table, I think they all
have their, each of their individual stories

1:29:59.381,1:30:04.520
and there are some elements that are I suppose
more popular than others like the lithiums

1:30:04.520,1:30:05.889
and the rare-earths and so on.

1:30:06.810,1:30:10.777
But we need to understand all of those dynamics
around all of them, and some of them can change.

1:30:10.777,1:30:14.174
And so I think you know whether it's tungsten,
whether it's lithium

1:30:14.662,1:30:18.160
and others, I think there's certainly you know
some really fascinating sort

1:30:18.160,1:30:24.448
of potential in them in the near future.
So I think we look forward to get getting stuck into

1:30:24.448,1:30:28.324
a whole range of those different questions, and
commodities, and technologies, so...

1:30:28.324,1:30:33.039
But again if you think of something like quantum
computing, it's not just the elements

1:30:33.039,1:30:40.045
it's also the high purity nature of them, isotopic purity,
all sorts of characteristics we really get to look at.

1:30:40.045,1:30:44.675
So I think that there's some other ways we can
look at these sorts of technologies and issues and

1:30:46.083,1:30:50.303
stuff we need to think about going forward.
I was about to add effectively how

1:30:50.303,1:30:56.952
how will AI develop in the future exponentially
potentially even faster than exponential development

1:30:56.952,1:31:02.600
at the current rates. How is that going to impact material
demand? How is that going to interact and change

1:31:02.600,1:31:08.235

the way we use different material, potentially
the discovery rate of new mineral deposits

1:31:08.235,1:31:15.000
if we apply AI into exploration? But also how does
AI improve the design of the materials that we use

1:31:15.000,1:31:20.000
currently, and how does that help us reduce
potentially some of the material intensity

1:31:20.000,1:31:22.821
in various applications?
A fantastic topic.

1:31:24.175,1:31:27.232
Sounds like a great subject for another webinar
down the road.

1:31:28.400,1:31:33.160
Okay, on that note can I extend my thanks
to both of you, Gavin and Pierre, for an excellent

1:31:33.160,1:31:36.714
presentation and answering so many
fantastic questions.

1:31:36.931,1:31:41.893
Also all the people that took the time to join us for
this webinar, we had a few hundred people join us live

1:31:41.893,1:31:47.117
which is fantastic. We've literally got 100 questions
which we'll take our time and respond to

1:31:47.117,1:31:50.888

and get a recording out.
So thank you very much for joining us.

1:31:52.946,1:31:55.655
Thank you very much.
Thank you, been a pleasure.