

PCA Case No. 2023-01

IN THE MATTER OF AN ARBITRATION

-before-

THE COURT OF ARBITRATION CONSTITUTED
IN ACCORDANCE WITH THE INDUS WATERS TREATY 1960

-between-

THE ISLAMIC REPUBLIC OF PAKISTAN

-and-

THE REPUBLIC OF INDIA

CERTIFIED TRANSCRIPT
(HEARING FOR THE FIRST PHASE ON THE MERITS)

COURT OF ARBITRATION:

Professor Sean D. Murphy (Chairman)
Professor Wouter Buytaert
Mr. Jeffrey P. Minear
Judge Awn Shawkat Al-Khasawneh
Dr. Donald Blackmore

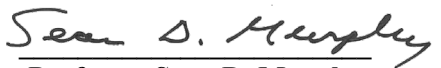
SECRETARIAT:

The Permanent Court of Arbitration

ON BEHALF OF THE COURT OF
ARBITRATION:

CERTIFIED PURSUANT
TO
PARAGRAPH 19 OF ANNEXURE G

10 July 2024



Professor Sean D. Murphy
Chairman

In the matter of an arbitration
pursuant to Article IX and Annexure G
of the Indus Waters Treaty 1960
PCA Case No. 2023-01

Permanent Court of Arbitration
Peace Palace
The Hague
The Netherlands

Day 3

Wednesday, 10 July 2024

Hearing of the First Phase on the Merits

Before:

PROFESSOR SEAN D MURPHY
HE JUDGE AWN AL-KHASAWNEH
DR DON BLACKMORE
MR JEFFREY P MINEAR
PROFESSOR WOUTER BUYTAERT

BETWEEN:

THE ISLAMIC REPUBLIC OF PAKISTAN
-and-
THE REPUBLIC OF INDIA

Transcript produced by Trevor McGowan
Georgina Vaughn and Lisa Gulland

APPEARANCES

FOR THE ISLAMIC REPUBLIC OF PAKISTAN

MR SYED MUHAMMAD MEHAR ALI SHAH, Commissioner for
Indus Waters, Ministry of Water Resources
MR ASAD KHAN BURKI, Legal Advisor, Ministry of Foreign
Affairs
MR ZOHAIR WAHEED, Office of the Attorney General
H.E. MR SULJUK MUSTANSAR TARAR, Ambassador of Pakistan to
the Kingdom of The Netherlands
MS FATIMA HAMDIA TANWEER, First Secretary, Embassy of
Pakistan to the Kingdom of The Netherlands
MR JAMAL NASIR, First Secretary, Embassy of Pakistan to the
Kingdom of The Netherlands
SIR DANIEL BETHLEHEM KC, Twenty Essex, London
PROFESSOR PHILIPPA WEBB, Twenty Essex, London
DR CAMERON MILES, 3 Verulam Buildings, London
PROFESSOR ATTILA TANZI, 3 Verulam Buildings, London
MR STEPHEN FIETTA KC, Fietta LLP, London
MS LAURA REES-EVANS, Fietta LLP, London
MR ABDULLAH TARIQ, Fietta LLP, London
MS MEGAN RIPPIN, Fietta LLP, London
DR GREGORY L MORRIS, Technical Advisor
MR PETER J RAE, Technical Advisor

THE REPUBLIC OF INDIA WAS NOT REPRESENTED

FOR THE PERMANENT COURT OF ARBITRATION

MR GARTH SCHOFIELD, Deputy Secretary General
MR BRYCE WILLIAMS, Legal Counsel
MR SEBASTIAN KING, Assistant Legal Counsel
MS VILMANTE BLINK, Senior Case Manager

Day 3 Overview1

 By Sir Daniel Bethlehem1

Himalayan Run-of-River Design and Operation:12

An Engineering Perspective (continued)

 By Dr Morris12

 Court questions15

 Court questions32

 Questions from THE COURT51

Incorporating a Run-of-River HEP62

in an Integrated Power System

 By Mr Rae62

 Questions from THE COURT105

Submissions on Baglihar and Kishenganga115

Systemic Interpretation Issues and Response to

Question (a)

 By Mr Fietta115

 Court questions131

 Court questions143

 Court questions149

 Court questions158

 Court questions163

 Questions from THE COURT179

Submissions on the Western Rivers Run-of-River182

Hydro Bargain

 By Professor Webb182

Court questions	191
Court questions	206
Questions from THE COURT	219

09:10 1 Wednesday, 10 July 2024
 2 (9.33 am)
 3 THE CHAIRMAN: Good morning, everyone. Good to see you
 4 again.
 5 I see that Sir Daniel is at the podium, perhaps to
 6 tell us how things will unfold over the course of the
 7 day. So, Sir Daniel, you have the floor.
 8 SIR DANIEL: Thank you very much, Mr Chairman. I hope that
 9 you managed to survive the deluge last night. It's only
 10 when we saw the orange rain warning that we appreciated
 11 the 5.30 stop yesterday evening!
 12 (9.34 am)
 13 Day 3 Overview
 14 SIR DANIEL: Mr Chairman, members of the Court, before
 15 Dr Morris stands up to continue his submissions of
 16 yesterday, let me just give you the very briefest of
 17 roadmaps of what you'll be hearing from us today. It
 18 will be building the next layer of the pyramid, getting
 19 narrower in focus, and preparing the foundation -- can
 20 you hear with the ...?
 21 THE CHAIRMAN: I think we will need to close the windows, at
 22 least temporarily, until we have less noise coming in
 23 from the outside. So if you'll just bear with us for
 24 a moment, Sir Daniel, we'll do that. (Pause)
 25 Okay, I think we are ready to proceed.

Page 1

09:36 1 And she will also address the Court's question 35(b) on
 2 the extent to which non-Treaty-based best practices can
 3 be or must be incorporated into the Treaty. A number of
 4 these issues have already been addressed, but these will
 5 take them to another level of detail.
 6 Mr Chairman, members of the Court, each of the
 7 submissions that you are hearing and have heard and will
 8 hear from us has the purpose of putting an additional
 9 layer of bricks into our interpretative structure, and
 10 to ensure that particular evidential underpinnings are
 11 properly cemented into that structure. It may not
 12 always be apparent with all of the presentations exactly
 13 what those bricks are, but we will attempt to draw all
 14 of the threads together; that's certainly one of the
 15 things that I'll attempt to do tomorrow morning.
 16 The purpose of Dr Morris's presentation, and which
 17 he is in the midst of, is both to provide you with
 18 an opportunity to revisit some of the design and
 19 operation issues that you heard about during the
 20 Neelum-Jhelum site visit and to make a number of points
 21 about the constraints that apply to the design and
 22 operation of all run-of-river HEPs in the Himalaya.
 23 Dr Morris will continue with this shortly.
 24 I know, for reasons of time constraint, there was
 25 perhaps a self-denying ordinance on your part not to ask

Page 3

09:35 1 SIR DANIEL: It is uplifting for the spirits to think that
 2 there is someone who is cutting the lawn outside while
 3 we are working in here.
 4 As I was saying, just before Dr Morris stands up to
 5 continue his submissions of yesterday, I'd like to give
 6 you just a brief roadmap of what you'll be hearing from
 7 us today. It will be building on the next layer of the
 8 pyramid, getting ever narrower in focus, and preparing
 9 the foundation a little bit more for the detailed
 10 submissions that you will hear from us tomorrow about
 11 the interpretation of the paragraph 8 design criteria.
 12 Following Dr Morris, you will have three submissions
 13 today. Dr Morris will be followed by Mr Rae, who will
 14 be addressing you on incorporating run-of-river HEPs
 15 into an integrated power system.
 16 After Mr Rae, we will return to the legal issues,
 17 with Mr Fietta then addressing you on Baglihar and
 18 Kishenganga systemic interpretation issues. And
 19 Mr Fietta will also be responding to the Court's
 20 question 35(a) on the effect of past decisions of Courts
 21 of Arbitration and Neutral Experts on future Article IX
 22 settlement processes.
 23 Mr Fietta will be followed by Professor Webb, who
 24 will address you on the Western Rivers run-of-river
 25 hydro bargain and the controlling effect of Article III.

Page 2

09:38 1 him questions -- perhaps there were no questions -- but
 2 please do feel free to put questions to him. One of the
 3 reasons why we have presented him here in an open-ended
 4 format, rather than through a witness statement or
 5 anything like that, was precisely to allow you to engage
 6 with him, including on the Neelum-Jhelum issues.
 7 I should note that Dr Morris's presentations of
 8 yesterday afternoon and today are also intended to
 9 provide the jumping-off platform for his second
 10 presentation tomorrow, which will be on approaching the
 11 paragraph 8 design criteria from the perspective of
 12 an engineer. So this is the foundation; tomorrow
 13 he will actually be looking at the texts.
 14 And as I say, we will be endeavouring to pull the
 15 threads together of these presentations during the
 16 course of tomorrow.
 17 Following Dr Morris, Mr Rae will be coming to the
 18 podium. And as I've already said, Mr Rae brings
 19 a rather unique experience and insight to the table.
 20 Unusually, as I understand -- our engineering colleagues
 21 will know more -- but unusually, as I understand, Mr Rae
 22 has an experience that goes from the design of HEPs
 23 through to their operation, rather than simply focusing
 24 on particular aspects of HEPs. And he is also a veteran
 25 of the Baglihar proceedings.

Page 4

09:39 1 His presentation on incorporating run-of-river HEPs
 2 into an integrated power system was in fact suggested to
 3 us internally, as we were reflecting on this hearing, by
 4 a number of the exchanges that you, the members of the
 5 Court, had with the site experts at the Neelum-Jhelum
 6 plant on how run-of-river hydropower plants would or
 7 might fit into an integrated power grid that was also
 8 fed by solar, by wind, by nuclear. But I think the
 9 focus of your questions, as I recall them from the site
 10 visit, was in particular with regard to renewable energy
 11 resources and environmental and climate change
 12 considerations. So the session, again, is intended to
 13 provide you with an opportunity to address these issues
 14 further with an expert engineer who is working in the
 15 field.

16 Following Mr Rae, we will return to the legal issues
 17 with Mr Fietta. And Mr Fietta's submissions on the
 18 weight that should be accorded to the conclusions of the
 19 Kishenganga Court and the weight or otherwise -- we say
 20 "or otherwise" -- that should not be given to the
 21 Neutral Expert's determination in the Baglihar
 22 proceedings are, of course, central to Pakistan's case
 23 and we appreciate that they will be central to your
 24 deliberations. Because one of the issues that we have
 25 put before you is: what weight is to be given to

Page 5

09:42 1 precisely is because in the period leading up to
 2 February 2016 -- you will recall that's when the letter
 3 was sent by the Pakistan Commissioner for Indus Waters
 4 to his Indian counterpart saying, "We're moving beyond
 5 all of the discussion about the Neutral Expert, we
 6 believe that this has to be taken to a Court of
 7 Arbitration, because we believe these questions need to
 8 be settled with systemic effect" -- and the reason why
 9 we are here is precisely because of the concerns about
 10 Baglihar; that these issues could not be addressed on
 11 a plant-by-plant basis for evermore; and that if the
 12 Indus Waters Treaty was to return to functionality, that
 13 it would be necessary to secure a binding interpretation
 14 of systemic effect on the meaning of the design criteria
 15 in paragraph 8 of Annexure D.

16 Mr Chairman, members of the Court, perhaps I might
 17 pause there to step away from my scripted remarks to
 18 make an observation, because it's one that has of course
 19 been weighing upon us; and we expect, in particular from
 20 some of the questions that you've been posing over the
 21 course of the last couple of days, that it is quite
 22 properly weighing heavily on your shoulders as well.

23 What this first phase of the merits is addressing
 24 are systemic issues. And what is going to be called
 25 upon from you is a systemic interpretation that is going

Page 7

09:41 1 Raymond Lafitte's determination in 2007 in Baglihar?
 2 We say the methodology was completely flawed and the
 3 conclusions were inconsistent with the Treaty. So these
 4 issues are central to our case, and they will be central
 5 to your deliberations.

6 The Kishenganga Court, we say, laid down some
 7 dispositive findings of systemic interpretation, notably
 8 with regard to -- but not confined to -- the prohibition
 9 on drawdown flushing or empty flushing, under the
 10 Treaty, which the Kishenganga Court actually dealt with
 11 as a systemic question, not simply as a question that
 12 was confined to the KHEP. And in so doing, the
 13 Kishenganga Court expressly rejected the Neutral
 14 Expert's analysis in Baglihar and the systemic
 15 application of his determination beyond the Baglihar
 16 HEP.

17 Mr Fietta will address these issues in the round.
 18 But in so doing, he will also respond to your
 19 question 35(a), which asked directly about the weight
 20 and effect of previous decisions of Courts of
 21 Arbitration and Neutral Experts.

22 Mr Fietta's submissions will, of course, also
 23 necessarily address the weight and effect that will in
 24 due course attach to your award in this first phase of
 25 the merits. And indeed, the reason why we are here

Page 6

09:43 1 to address all of these issues, for evermore, for all of
 2 these treaties.

3 We very much appreciate that this will weigh heavily
 4 upon you. And one of the reasons why we're going into
 5 such small and sometimes, it may appear, such tedious
 6 detail is that we would like you to have the evidential
 7 underpinnings for every single issue that you feel you
 8 need to join up in order to reach your systemic
 9 interpretation. But I'll come back to that perhaps in
 10 my closing on Friday.

11 Following Mr Fietta, Professor Webb will return to
 12 the interpretative issues. And she will focus on
 13 peeling back the skin in greater detail on what we say
 14 is the Western Rivers run-of-river hydro bargain; that
 15 is the third of the bargains embodied in the Treaty.
 16 You will recall that the hydro bargain is the bargain
 17 that is constructed, as we have characterised it -- we
 18 believe correctly -- around the rule and the exception
 19 for hydroelectric power in Article III and Annexure D.

20 Mr Chairman, I come on to make an observation which
 21 I think goes to your exchange with Professor Webb around
 22 the Waldock drafts. She will come back to those in due
 23 course, but let me just make the observation in advance
 24 of her.

25 The rule of unrestricted use, as you know, is that

Page 8

09:45 1 of Pakistan's right to unrestricted use of the waters of
 2 the Western Rivers, and India's corresponding
 3 obligations of let flow, non-interference and no
 4 storage, subject to certain tightly constrained
 5 exceptions. So I think that's the way that we are
 6 characterising it; Professor Webb will deal with it more
 7 fully.
 8 When one has a look at the language of Article III,
 9 paragraph 1 and Article III, paragraph 2, the rule is
 10 unrestricted use. That's our right, Pakistan's right.
 11 The corresponding obligation on the part of India is let
 12 flow, no storage, non-interference, and then subject to
 13 the exceptions, in particular for hydroelectric power
 14 here.
 15 Just going back to the exchanges yesterday, in
 16 particular with Ms Rees-Evans around the travaux
 17 préparatoires, let me just underscore, in case the point
 18 has not come across clearly enough or in case it's been
 19 caught in the mangle of the move from the travaux to the
 20 Treaty, it has never been Pakistan's case that it has
 21 an unfettered right to use the waters of the Western
 22 Rivers. That's not what the Treaty says. Pakistan's
 23 case is that it has a right to the unrestricted use of
 24 those waters, and that India is subject to imposing
 25 obligations in respect of that right. But Pakistan

Page 9

09:48 1 been very much like a pyramid, starting with the
 2 broadest of brushes and building up, and from tomorrow
 3 you'll begin to have sight of the summit. The summit is
 4 where the air is thin, where the temperatures are cold,
 5 where the winds blow, but also where the end is in
 6 sight.
 7 So thank you very much. With that, I'd invite you
 8 to ask Dr Morris back to the stand.
 9 THE CHAIRMAN: Very good. Thank you, Sir Daniel, for those
 10 very helpful introductory comments. We appreciate as
 11 well your revisiting some of the points that were raised
 12 in prior questions to give us a little bit more insight
 13 into Pakistan's position, and appreciate that it will be
 14 followed up as well in due course by others in their
 15 presentations.
 16 So at this point I do invite Dr Morris to return to
 17 the podium for the completion of his presentation from
 18 yesterday.
 19 SIR DANIEL: Mr Chairman, perhaps while Dr Morris is just
 20 setting up all of his electronics, I might just add --
 21 you may be aware of this because this is a discussion
 22 that we've had with the Secretariat and with the
 23 technicians -- Dr Morris does not only have his
 24 presentation on his laptop but he is also iPad-enabled
 25 and has the facility to speak through drawings, not only

Page 11

09:47 1 acknowledges that the right is subject to exceptions.
 2 But we also go on to say that the exceptions are
 3 tightly constrained and must be construed for what they
 4 are: exceptions to a right, not as a self-standing
 5 provision of entitlement that avails India without
 6 regard to Pakistan's right. And perhaps this comes to
 7 the Fitzmaurice/Waldock debate, if I can put it in those
 8 terms.
 9 The exception for hydroelectric power is a carve-out
 10 from Pakistan's right of unrestricted use, in which the
 11 attribution of the right also expresses the exception,
 12 with a renvoi to Annexure D. You find the headline
 13 right in the same provision you find the exception, and
 14 then you have articulation of the detail of the
 15 exception in Annexure D. It's not that you have a right
 16 and somewhere else in the Treaty, semi-detached, you
 17 have an exception. Perhaps, Professor Murphy, this goes
 18 to your question yesterday. But as I say,
 19 Professor Webb will come back and unpack that all.
 20 Then finally, Mr Chairman, members of the court,
 21 starting tomorrow, we will endeavour to draw the threads
 22 together of all of these various presentations and apply
 23 them to the interpretative task of construing the
 24 paragraph 8 design criteria. And I do emphasise and
 25 again have in mind that our approach to all of this has

Page 10

09:50 1 words.
 2 The reason why I mention this is because we have had
 3 discussion with the Secretariat and with the technicians
 4 just to make sure that the drawings are also properly
 5 captured in the record, so that they are not sort of
 6 somehow lost. The drawings will be the engineer
 7 speaking through his drawings, rather than through his
 8 words.
 9 THE CHAIRMAN: Very good. Thank you very much.
 10 Dr Morris.
 11 (9.50 am)
 12 Himalayan Run-of-River Design and Operation:
 13 An Engineering Perspective (continued)
 14 DR MORRIS: (Slide 30) Good morning. (Pause) Today in the
 15 morning I'll start talking about management options to
 16 preserve reservoir capacity. (Pause)
 17 (Slide 31) This diagram outlines four basic ways to
 18 manage sediment. And sediment management is something
 19 that historically, in storage reservoirs, you would
 20 design a reservoir to have 50 to 100 years of sediment
 21 storage. That was the way to manage it, and in the
 22 future then someone else will deal with the problem.
 23 But run-of-river plants are very interesting because
 24 they have historically not had large storage capacities.
 25 So the sediment problem that many storage reservoirs are

Page 12

09:51 1 facing today were addressed early on -- and I mean early
 2 on in the prior century -- and addressed successfully by
 3 the run-of-river plants. So a lot of the techniques
 4 that are being applied to storage plants today actually
 5 originated with the run-of-river plants.
 6 So it's kind of interesting to see that the
 7 run-of-river plants were actually the precursors of
 8 successfully implementing sediment management strategies
 9 which are now being moved into the realm of storage
 10 plants. I just want to make that clear. And I learned
 11 quite a bit about sediment management that would be
 12 viable in a storage plant based on lessons learnt from
 13 run-of-river plants.
 14 Now, basically, this is a diagram that I worked up
 15 some years ago, but it shows four basic strategies: you
 16 can reduce sediment yield, you can route sediments, you
 17 can remove deposited sediment or you can adapt to
 18 sediment. In other words, the adaptive strategies are
 19 things that you do when you're not touching the
 20 sediment, but you're, like, for instance, putting
 21 coatings on a turbine or something like that.
 22 (Slide 32) Basically, reducing sediment yield:
 23 erosion control. Routing sediments is passing the
 24 sediments through or around your storage. Removal:
 25 flushing and dredging. And your adaptations: turbine

Page 13

09:53 1 coatings, et cetera.
 2 (Slide 33) Watershed management in the High Himalaya
 3 is quite limited, the potential is quite limited,
 4 because successful watershed management focuses on the
 5 restoration of vegetation. We see that when you have
 6 excessive grazing, poor agricultural practices, that you
 7 destroy the soil cover, you destroy the vegetative
 8 cover, and this greatly accelerates the erosion rates,
 9 by a factor of, say, 100. It's not unusual to see
 10 a hundredfold increase in erosion rates on properties or
 11 pieces of land that have been degraded.
 12 So watershed management, where you have enough water
 13 and the climate is amenable to vegetation, you can
 14 achieve very considerable improvements in reducing the
 15 sediment load. And we have in the United States
 16 a number of areas of the country where we see quite
 17 a dramatic decrease because of all the conservation
 18 programmes that have been worked on in farms.
 19 Pakistan, in the Mangla Reservoir watershed, has
 20 also been successful in reducing sediment loads by
 21 watershed works. But High Himalaya, it's not going to
 22 work up there. So it can work in the proper
 23 environment -- but the potential for this to work in the
 24 Himalaya is limited because you have landslides, which
 25 of course are accelerated by things such as road

Page 14

09:54 1 construction -- but it's not a cure-all, by any means.
 2 Let me make one more comment. As a dam owner, if
 3 you want to change your watershed, you have to deal with
 4 thousands of people and thousands of property owners.
 5 So when I deal with dams, I say: yes, you can look at
 6 watershed, you should deal with it; but really you need
 7 to focus on how you're going to operate what you can
 8 control.
 9 So we have two -- yes.
 10 THE CHAIRMAN: Dr Morris, if you don't mind, Dr Blackmore
 11 has a question for you.
 12 DR BLACKMORE: I liked the introduction and the contrast.
 13 I was just interested though on the Himalayas. Because
 14 we're going to move on to reservoirs now, but before we
 15 do that, more generally I'd like you to give me your
 16 understanding of sediment generation through seismic
 17 activity in the Himalayas, because we know we can't
 18 manage that, but whether that's a significant issue,
 19 from your perspective.
 20 DR MORRIS: It's a significant issue because it helps to
 21 generate landslides.
 22 There was one of the reservoirs, Kulekhani, in
 23 Nepal, there was an earthquake and there was also
 24 a large monsoon which tended to coincide in time, and
 25 dramatic loss in sediment. The place where I've seen

Page 15

09:56 1 this the most severe is in Taiwan, which is where I was
 2 able to really visualise it.
 3 Earthquakes produce landslides, and they produce
 4 scars on the landscape, and that is where you are
 5 generating your sediment. A landscape scar can produce
 6 easily 100 times more sediment per square metre of land
 7 surface compared to vegetative land which is next door.
 8 So seismic activity is important, but it's just part
 9 of the picture. But it's definitely an important part.
 10 DR BLACKMORE: So the Indus Valley was created by erosion.
 11 DR MORRIS: Mm.
 12 DR BLACKMORE: And we've now effectively cut off -- we've
 13 got sediment traps --
 14 DR MORRIS: Yes.
 15 DR BLACKMORE: -- called dams that have cut off the vast
 16 majority of sediment and silt getting to those
 17 landscapes. So I just want to understand, from your
 18 perspective, the bigger picture, before we go back to
 19 dealing with the small.
 20 So we now have three major dams, and a whole lot of
 21 smaller dams around, that have effectively cut off the
 22 flow of sediment, changed the morphology of the river.
 23 And I'm just wondering, given that you have given this
 24 a great deal of thought, what do you see as the future
 25 of the area downstream of these dams, and what happens

Page 16

09:58 1 if you reintroduce sediment?
 2 DR MORRIS: That is a wonderful question, and that is the
 3 next challenge.
 4 When you talk about geology, you talk about
 5 long-term periods. When you talk about dams, you're
 6 talking about a blip in geology. This is one of the
 7 things that I have been working with Pakistan to have
 8 them understand, as well as other countries. But
 9 particularly Pakistan, because I think Pakistan has
 10 probably the most severe water resource problem of any
 11 country in the world, in terms of the challenge that it
 12 faces. And one of the challenges -- the big
 13 challenge -- is exactly what you put your finger on: the
 14 sediment.
 15 For instance, along the Indus, we have Tarbela,
 16 which has now lost over 40% of its capacity; we have
 17 Dasu, which is being built upstream; and we also have
 18 Diamer-Bhasha upstream. But even if you let
 19 Diamer-Bhasha and Dasu fill to their design level, you
 20 only buy 40 years of storage at Tarbela.
 21 You cannot stop erosion in the Himalaya: it's going
 22 to go downstream, and it's going to go downstream either
 23 over the dam or through the dam or around the dam. It's
 24 going to get downstream.
 25 And one of the issues at Tarbela is that you do not

Page 17

10:01 1 and into the ocean, which is ideal. But in my visits
 2 and discussions with the operators at Kotri Barrage --
 3 which is the most downstream barrage on the Indus, just
 4 before it goes into the Arabian Sea -- they have assured
 5 me that the recent -- not "recent", but this is just
 6 pre-Covid recent -- that their modifications and
 7 rehabilitation allows them to divert all the remaining
 8 water to irrigation.
 9 So we have a river with a large sediment load, very
 10 little water going to the sea, and we have to deal with
 11 what we're going to do. We do not yet have the answer,
 12 but we will find the answer. And if we don't find the
 13 answer, it's going to happen anyway.
 14 The dams are only temporary. They can only store
 15 a very small amount of sediment compared to what geology
 16 is giving us.
 17 DR BLACKMORE: I'm only following this line of enquiry
 18 because when you've got a hydraulic civilisation like
 19 Pakistan, or in Egypt on the Nile, with Aswan, and many
 20 others we could spend hours talking about, you've bought
 21 a period of time when you've got stability; and then
 22 you've got a period of time when you have instability,
 23 because you'll change the morphology of the river,
 24 depending on how you elect to transport.
 25 How long -- you said "finite", so I wondered whether

Page 19

09:59 1 have the option of walking away from it. Tarbela has
 2 got about 150 million tonnes of sediment. Of that,
 3 about 70 is sand. Sand going over the flip bucket will
 4 reach a velocity of about -- there's two spillways, and
 5 the velocity will be in the range of 40 metres a second.
 6 And you put 40 metres a second, 70 million tonnes of
 7 sand against a flip bucket, and your spillway is gone in
 8 one monsoon. You lose your spillway, the dam can fail:
 9 catastrophic downstream consequences. You cannot run
 10 away from it, you have to deal with it.
 11 So the whole objective that we're focusing on, after
 12 getting through this hearing, is working on the Indus to
 13 try and create a system where we can run sediment from
 14 the upstream, through the two reservoirs, through
 15 Tarbela and into the downstream.
 16 What are we going to do with the sediment? That's
 17 the big question everybody wants to know. And it's
 18 really interesting because, in very round numbers, we
 19 have about 200 million tonnes of sediment a year. We
 20 have 100,000 square kilometres of irrigated area. That
 21 is equivalent -- when we correct for bulk density
 22 et cetera, it's about 1.5 millimetres of deposition on
 23 the floodplain -- on the irrigated floodplain -- in
 24 a year.
 25 The other option, of course, is to run it downstream

Page 18

10:02 1 you had a number for how long before remedial action, of
 2 the nature of passing sediment in a controlled way, or
 3 managed way, or whichever word we want to use -- how
 4 long before we reach that for something like Tarbela, in
 5 your view?
 6 DR MORRIS: Ideally, it would have been already working.
 7 Realistically, it will take at least ten years to get
 8 something put together and operating.
 9 But there's not a lot of time available. Like
 10 I said, Tarbela has lost about -- Tarbela started
 11 impounding in 1975. Here we are in 2024 and it's
 12 already lost a little more than 40% of its capacity. So
 13 it's -- and the two upstream reservoirs, if you're going
 14 to use them for power, you have to manage them
 15 appropriately.
 16 DR BLACKMORE: So we've now accumulated all this sediment,
 17 and it's got a slope to it from the delta through to the
 18 outlet works. And I understand the outlet works have
 19 been expanded so that we're excluding sediment going
 20 through the turbines for a period of time.
 21 DR MORRIS: They're being lifted, yes.
 22 DR BLACKMORE: So I'm interested in what happens if we have
 23 a seismic event now, given that we've got -- I first
 24 took evidence on this in 1998, in Sri Lanka. And I'm
 25 just interested in the evolution of time: where it was

Page 20

10:04 1 known as a problem, there was no solution at the time.
 2 And I'm just wondering whether there's still the
 3 possibility of a catastrophic event, caused by
 4 an earthquake blocking the sediment over the outlet. So
 5 I'm wondering what thinking has been going on in that
 6 space.
 7 DR MORRIS: Yes. That has been a real concern at Tarbela.
 8 And there was an extensive study done in 2013 -- which
 9 is, what, 12 years ago, 11 or 12 years ago -- and they
 10 reanalysed that issue. Their conclusion was that the
 11 slope on the delta is about 2%.
 12 And the delta actually has two slopes: you have the
 13 face of the delta, and it flattens out; and then in
 14 front of the intakes, you have a scour cone that goes
 15 down to the intakes, where the slope in some areas is as
 16 high as 3%.
 17 But the conclusion was that for slopes less than 2%,
 18 the earthquake shaking would not generate a slide which
 19 would be self-propagating. I should say: an underwater
 20 landslide. That it would move a little bit, but it
 21 wouldn't destabilise the entire delta. You wouldn't
 22 have this massive blocking. With the raising of the
 23 intakes, that problem, that danger, is essentially
 24 eliminated for the time being. And so that's why it's
 25 important now to stabilise this and work in that

Page 21

10:06 1 direction.
 2 Just let me make one more point here. I'm going to
 3 talk about dredging in a minute, but since we're on
 4 this.
 5 In the Indus cascade, the three reservoirs, you have
 6 the Diamer-Bhasha, you have Dasu, Tarbela and
 7 Ghazi-Barotha, which is another 1,400 MW plant that is
 8 basically connected -- it takes the water that comes out
 9 of the turbines in Tarbela and passes them another
 10 50 kilometres downstream. That's about 14,000 MW of
 11 capacity. You can't turn 14,000 MW off. I mean, the
 12 country won't have power.
 13 So what we're looking at is a way where we operate
 14 the top reservoirs to pass sediment down to Tarbela, and
 15 at Tarbela we use dredging. And dredging sounds like
 16 a crazy idea, and when I started studying Tarbela
 17 I said: dredging is a crazy idea, because it's too
 18 expensive.
 19 But Tarbela produces power at less than 1 cent per
 20 kilowatt hour, US. Why? It's paid for. It's paid-for
 21 infrastructure. All you're doing is operating it. And
 22 the operational cost of hydropower is the cheapest thing
 23 there is: it's cheaper than solar. Like I mentioned
 24 yesterday, the plant that I was at in Peru, it's running
 25 on 100-year-old equipment and it's producing power and

Page 22

10:07 1 generating money.
 2 So when we worked out the numbers on dredging,
 3 you can dredge Tarbela and pay for it by doubling the
 4 cost of power. Your power from Tarbela will go from
 5 1 cent to 2 cents, which would still make it the
 6 cheapest source of power that there is.
 7 The other interesting thing is that they did look at
 8 flushing at Tarbela. And what happens is that if you
 9 flush Tarbela, you have to turn the turbines off for
 10 a minimum of 30 days, maybe closer to 45. 30 days,
 11 power off at Tarbela. Buying replacement power from
 12 a fossil fuel plant will cost you about \$500 million for
 13 one month. And for \$500 million, we can do a lot of
 14 dredging. So ...
 15 THE CHAIRMAN: Thank you, Dr Morris. It's been a very
 16 interesting discussion, but I have to confess -- and
 17 this may be the lawyer in me -- I'm not entirely sure
 18 I understand the relevance of Pakistan's management of
 19 sediment downstream for the purposes of this case.
 20 It strikes me that there's value in understanding
 21 how one can control sediment in upstream dams other than
 22 using, say, drawdown flushing. That seems of relevance.
 23 But another possible relevance is, to the extent that
 24 Pakistan wishes to avoid sediment flows, there might be
 25 some value in having a lot of upstream dams that are

Page 23

10:09 1 taking sediment out of the river.
 2 So I'd be interested in your reflections on just the
 3 relevance of what it is you're talking about for
 4 purposes of the case.
 5 DR MORRIS: Yes, okay.
 6 What I'm trying to do in this presentation is to
 7 give you an idea of the variety of options that we have
 8 in sediment management. And the Tarbela example is,
 9 I think, a good example because it shows that they
 10 looked at flushing here as the logical first thing you
 11 think about, and it turns out that it's not feasible
 12 because of the amount of power that you have to forgo.
 13 And this is a problem when you do flushing at any plant.
 14 Any plant.
 15 So in that respect, I know that India is very
 16 focused on doing flushing. But at the same time, we are
 17 not clear that they have really put into the equation
 18 two things: (1) the cost of turning those plants off,
 19 the implications of turning the plants off for flushing;
 20 and (2) the downstream implications of releasing
 21 sediment downstream. Because when you flush, you
 22 basically are taking one year's worth of sediment and
 23 releasing it in a slug. If you're going to flush once
 24 a year, you're going to release all that sediment in,
 25 what, a week?

Page 24

10:10 1 So these are the types of problems that are inherent
 2 in flushing as a strategy, and we'll go into that in
 3 a couple of minutes. So like I said, I think it's
 4 relevant what happens in lots of different reservoirs
 5 because it shows that there's a lot of different
 6 strategies available.
 7 (Slide 34) Let me continue with this and just say
 8 that the sediment routing techniques, we have off-stream
 9 storage, we have on-stream storage, we have bypass
 10 tunnel or we can do a compartmented reservoir.
 11 Compartmented doesn't really apply here because it's
 12 more for flat land with round reservoirs. And we can
 13 pass through, where we have turbidity currents or
 14 drawdown sluicing.
 15 (Slide 35) Off-channel storage is basically where
 16 you use an intake to divert water into an off-stream
 17 storage reservoir. This is in Colombia, it's in
 18 a mountainous area of Colombia, and they have two
 19 reservoirs in series. I worked with this project and
 20 I just thought it was an interesting example.
 21 (Slide 36) This photograph is from the Tinguiririca
 22 project in Chile, where you have -- it's probably
 23 4,000 metres elevation. I'm converting to -- it's
 24 around 3,500 metres elevation. And they had the unique
 25 situation in their topography where they could use

Page 25

10:12 1 an off-stream storage.
 2 The dam is actually right here: you can see the dam
 3 (indicating). It was affected by a debris flow event:
 4 the dam was completely filled with sediment, boulders.
 5 But the off-stream reservoir retained its capacity, and
 6 the operators insisted that they had had no problem and
 7 they had not had appreciable sedimentation.
 8 So it's a strategy which is not a general strategy,
 9 but there are places where it will work.
 10 (Slide 37) The bypass tunnel, we have discussed that
 11 a little bit. But the objective of the bypass tunnel is
 12 to pass your sediment-laden flows around the zone that
 13 you're preserving for pondage uses. In my own work in
 14 the Himalaya, I've found that this tends to be a good
 15 strategy for smaller reservoirs. It doesn't really pan
 16 out for larger reservoirs, where we have longer tunnels,
 17 et cetera. And you can design these tunnels so they can
 18 pass bed load, or they can pass suspended load only.
 19 (Slide 38) This is an example from Japan. This is
 20 actually for a pumped storage project. This is the
 21 lower dam which is on the river, and then they have
 22 a higher reservoir which has only a very small
 23 watershed. But this is at the upstream end of the
 24 reservoir. And the cofferdam, when they draw it down,
 25 the cofferdam diverts bed material. You see the gravel

Page 26

10:13 1 on the bottom. It diverts it into the tunnel and
 2 releases it about 3.5 kilometres downstream. I think
 3 it's about a 3-kilometre tunnel, if I remember
 4 correctly.
 5 So bypass tunnels can be designed for bed material,
 6 can be designed for suspended material. What I have
 7 done in the projects we've worked with is design them
 8 for suspended load rather than bed load, because the bed
 9 load tends to degrade the invert of the tunnel.
 10 We do have an example in Pakistan, the Patrind
 11 project, which is not too far away from Neelum-Jhelum:
 12 it's about 100 kilometres, I think. It does incorporate
 13 a bypass tunnel. So it is something which now has been
 14 used in the Himalaya.
 15 (Slide 39) Drawdown sluicing is a strategy by which
 16 you open the gates of the reservoir during a flood
 17 event. Most of your sediment -- not most, but a large
 18 portion of your sediment, is delivered during flood
 19 events. It depends on your hydrology. But, for
 20 instance, in the Caribbean, some areas of South America,
 21 Taiwan, where you get typhoons and cyclones, you can get
 22 half your annual sediment load in one or two days
 23 a year. In the Himalaya it's more spread out over time,
 24 but you still have these very large events that produce
 25 a lot of sediment.

Page 27

10:15 1 And the objective in drawdown sluicing -- as seen in
 2 part (B) of this slide, down at the bottom -- is to open
 3 the gates when the flood is not yet arrived at the dam,
 4 so if the dam is drawn down, and the flood can pass
 5 through it.
 6 Now, in the Himalaya, with a prolonged wet season,
 7 the strategy which is typically employed is to keep the
 8 gates open, keep the water level at the minimum
 9 operating level -- which in the Treaty is called the
 10 "Dead Storage Level" -- and keep it at that level during
 11 the entire wet season, because that changes your
 12 reservoir, your pondage pool, into a river.
 13 And instead of holding the water level at the top of
 14 the pondage pool, you drop it to the bottom of the
 15 pondage pool. So the pondage pool is not accumulating
 16 sediment because it's empty. It will accumulate some
 17 sediment upstream in the delta, but the pondage is empty
 18 and therefore it's not going to accumulate sediment.
 19 And the area from the bottom of the pondage pool to
 20 the bottom of the reservoir is flowing as a river,
 21 particularly during the large events, so that you can
 22 pass a 10- or 20-year flood at a high velocity, and
 23 that's what maintains that profile.
 24 Basically, the difference between sediment flushing
 25 and sediment routing is that this top one is the

Page 28

10:17 1 sediment sluicing. You see here? I'll get the cursor.
 2 During the dry season, the pondage pool gets filled, and
 3 the levels fluctuate up and down on a daily basis. And
 4 during the wet season, you drop the water level, and
 5 maintain the water level at your minimum operating
 6 level, which allows you to operate your turbines
 7 throughout the year, you don't have to have the
 8 shutdown. And then at the end of your wet season, you
 9 refill and operate the pondage again.
 10 In contrast, flushing. You have these flushing
 11 events: maybe one, maybe two, maybe -- in extreme
 12 cases -- three per year. And you may operate the plant
 13 at the maximum level, or you could also operate it at
 14 a sluicing level. But the difference is that the
 15 flushing requires these deep drawdowns. And that is
 16 where the issue with the Treaty comes in. So the top
 17 one, because you're not drawing down below the dead
 18 storage level, is compliant, and the bottom one is not
 19 compliant.
 20 (Slide 40) The advantages of preserving capacity by
 21 sluicing is that the power plant can remain in
 22 operation, subject to sediment-guided operation.
 23 Remember we mentioned yesterday that some of these days
 24 have very high sediment loads, so there are going to be
 25 a couple of days a year where you will probably want to

Page 29

10:20 1 collected in the riverbed and it came up 3 or 4 metres.
 2 And we had to then have a secondary release of clear
 3 water to help move this material downstream.
 4 So flushing is not just "Let me get the sediment out
 5 of the reservoir"; it's "I've got to do something
 6 downstream too".
 7 The high flows during sluicing maximises the width
 8 of the channel. Now, if you have a river, rivers have
 9 a certain dimension, and those dimensions are created by
 10 nature. And you have a low flow, and you have a little
 11 river; and you have higher flows, you have a bigger
 12 river. And the size of this river channel is,
 13 geomorphically speaking, equivalent more or less to
 14 about a two-year discharge. Then it starts to overflow
 15 into floodplains, et cetera.
 16 When you have a reservoir that you're going to
 17 maintain by flushing or sluicing, you have to put as
 18 much water as possible through it to make that wide
 19 enough. Because if you start flushing with a small
 20 flow, you have essentially converted the river into
 21 a small river instead of a big river. Because,
 22 remember, the river is determined by your large flows:
 23 that gives you the dimension of the channel. And if you
 24 flush with small flows, the channel dimension in your
 25 reservoir is going to be smaller. So sluicing allows

Page 31

10:18 1 either turn the plant off or run at, say, half power.
 2 Really important is the second item here: the
 3 sediment that's released downstream is released over the
 4 period of the wet season or by floods. That large
 5 volume of water dilutes the sediment, so your
 6 concentrations remain within a more or less natural
 7 range, and it gives you the hydraulic capacity you need
 8 to move it downstream. When you flush on an annual
 9 basis, let's say, you get this big slug of sediment, and
 10 you can't just close the gates when the reservoir gets
 11 empty.
 12 In other words, imagine you draw the reservoir down,
 13 open the gates, empty it, it flushes out. Okay, I've
 14 released the sediment that I want to release from my
 15 reservoir, now I'm going to close the gate. But what
 16 happens when you close the gate: all that sediment you
 17 released downstream just settles into the river, and it
 18 settles into your irrigation canals or wherever.
 19 And what we have seen in, for instance, Sanmenxia in
 20 China, on the Yellow River: they have had to release
 21 a significant amount of clear water after the flushing
 22 event so that this stuff moves downstream.
 23 When we did the flushing experiments at Warsak
 24 Reservoir in Pakistan two years ago, we did a rapid
 25 drawdown, we released a lot of sediment, and the sand

Page 30

10:21 1 you to pass the large floods through the reservoir and
 2 gives you the maximum width.
 3 Go ahead.
 4 THE CHAIRMAN: Dr Morris, are there circumstances in the
 5 Himalayas where, to deal with sediment at a particular
 6 site, you do find it necessary to use something like
 7 flushing, either as the exclusive means of addressing
 8 the sediment issue or as at least a partial means, in
 9 conjunction with other possibilities?
 10 DR MORRIS: That is a very interesting question, and I need
 11 to answer it in the following manner.
 12 You have flushing here on the left and sluicing here
 13 on the right, but there is this big area in between, and
 14 there is no fixed line that says, "This is flushing and
 15 this is sluicing". Because I can put my gates -- my
 16 sluicing gates or my flushing gates, whatever name
 17 we want to apply -- I can put them at an elevation of
 18 100 metres or 99 metres or 98 metres or 97 or 96 or 95:
 19 I can move the gates down 1 metre at a time. And when
 20 we do the simulations, that's basically what we do:
 21 we look at all the different levels, the types of
 22 control we get. So it's not really a black and white
 23 demarcation: is this flushing or is this sluicing?
 24 The overall objective in sluicing is to maintain
 25 flow downstream during flood events; you want to

Page 32

10:23 1 minimise deposition. Flushing, on the other hand, is
 2 focusing on scouring previously deposited sediments and
 3 then releasing that downstream. When you do sluicing,
 4 you will get scour of previously deposited sediments.
 5 When you do flushing, you will get some sediment
 6 pass-through with whatever your flushing flow is. So
 7 it's really something of a misnomer to say that this is
 8 exactly sluicing or flushing.
 9 But what happens in the case of the Treaty is you
 10 have a line which just says that: if you draw down below
 11 this level -- which is dead storage -- then we could
 12 consider it to be flushing; whereas if you can keep it
 13 to that level, we can consider it to be sluicing. But
 14 some projects, there's very clear flushing; some
 15 projects, very clear sluicing. And some projects are:
 16 well, maybe, either way; you could describe it either
 17 way.
 18 THE CHAIRMAN: I guess another way of putting my question
 19 is: assuming we do have the Treaty constraints in place,
 20 and assuming that they prohibit a particular type of
 21 deep orifice that would normally perhaps be used for
 22 flushing, are there circumstances where you, in
 23 complying with that requirement, would not be able to
 24 build a dam at a particular site; or will there always
 25 be, in your view, alternative means of sediment control

Page 33

10:26 1 flushing, just because of where I've decided to locate
 2 the dam.
 3 So there's two ways of approaching the design
 4 problem. And for conceptual means, we'll just say
 5 we pick the powerhouse site, and we can put the dam
 6 upstream or we can put it downstream. But the
 7 consequences for sediment management are completely
 8 different.
 9 And I'll have a diagram of that on Thursday that
 10 will explain that maybe a little bit more clearly.
 11 THE CHAIRMAN: That's very helpful, thank you. Please
 12 proceed.
 13 DR MORRIS: Now, I did mention that you will get delta
 14 deposition when you do sluicing. But what we've seen in
 15 the Himalaya, in the projects I've worked with
 16 throughout the Himalaya, the bed material, the bed-load
 17 transport, is very low compared to suspended load. So
 18 the delta deposition has not been a major issue for the
 19 big material. The sand we can move. But the delta,
 20 with moving big cobbles and gravels, has not been
 21 a significant problem.
 22 Disadvantages of sluicing: you have to have
 23 a desander; and you're probably going to face increased
 24 turbine repair cost.
 25 (Slide 42) One other thing that I think is important

Page 35

10:25 1 that could be employed?
 2 DR MORRIS: Within the constraints of the Treaty, you cannot
 3 do anything you want at a site. And we'll get into this
 4 more on Thursday.
 5 But just imagine that if we have a small dam that
 6 we can sluice sediment, we can put the powerhouse
 7 downstream at the end of a tunnel, and that will give us
 8 200 metres of head, let's say. But I can also make
 9 a very tall dam at the site of the powerhouse with
 10 a very short tunnel, and what I've done is I have
 11 converted my small and narrow reservoir into a very wide
 12 reservoir.
 13 Because remember, what we saw yesterday is, as you
 14 go deeper and deeper and deeper, you go up in elevation,
 15 the reservoir gets wider. So as it gets wider, this
 16 flushing channel, which is only going to be a certain
 17 width because you only have a certain discharge, the
 18 flushing channel now is a small portion of the entire
 19 width of your reservoir at the higher elevation, whereas
 20 initially it was occupying the full width of the
 21 reservoir.
 22 So whereas on a given river, at one location for
 23 a power plant, I can put a small dam upstream and
 24 control sedimentation; but if I move the dam downstream
 25 and make it a very tall dam, now I am forced to go to

Page 34

10:28 1 to understand is, if you're going to have a -- let's
 2 call it a "sluicing level" at this level (indicating),
 3 that water level at the dam will define the water
 4 surface profile going upstream and the equilibrium
 5 profile for the sediment. You, for instance, run
 6 a hydraulic model or a sediment transport model, and
 7 what you define to run the model is that water level at
 8 the dam.
 9 So if I establish the water level at the dam, I can
 10 achieve that by, in this example, a crest-gated spillway
 11 or a deep orifice spillway. In both cases, the water
 12 level at the dam is the same, so my sediment profile
 13 will be the same, except that at the orifice spillway
 14 we'll have a steep scour cone, which is typically rather
 15 steep. In Tarbela, it's not so steep because it's
 16 a fine sediment. But if it's sand, it will be close to
 17 the angle of repose, the submerged angle of repose.
 18 So it's just important to understand that if you do
 19 have a defined profile and a defined water level, that
 20 you don't get anything extra by putting the outlet
 21 deeper.
 22 (Slide 43) Now, let's use just a quick example of
 23 a sluicing project. This is Kali Gandaki: it's
 24 a small -- I'll put in parentheses "small" -- 144 MW
 25 project in Nepal. But this is not a small river. When

Page 36

10:30 1 we want to look at this and compare it to, say, the
 2 rivers in the Treaty area, the sediment load here --
 3 we'll go to the next slide (44). Look at this number:
 4 43 million tonnes a year. By comparison, the sediment
 5 load of the Chenab at Baglihar is half of that. Chenab,
 6 20 million; Kali Gandaki, in the order of 40 million.
 7 So this little project is managing twice the load
 8 that Baglihar gets. It's got a surface intake. It's
 9 got a desander. They've had abrasion problems, which is
 10 one of the reasons why I was involved in this project
 11 for several years, and different types of studies.
 12 And this is a project that is located about
 13 200 kilometres to the west of Kathmandu: it supplies the
 14 Pokhara area. And there was no good grid connection at
 15 the time. So the plant had to run 24/7 regardless,
 16 because it was the major plant supporting the grid for
 17 that area of the country.
 18 They did not have a good operator training
 19 programme. They were taking data; they weren't looking
 20 at the data. They did not have coated turbines. They
 21 did not perform sediment-guided operation.
 22 You can't see the intake here because it's buried
 23 under -- I mean, this is the winter and it's high level.
 24 But the intake had a kink in it. It was not in the
 25 design; the contractor just built it that way, no one

Page 37

10:31 1 could figure out why. But that, of course, impaired
 2 intake efficiency in excluding sand. Of the total load
 3 coming into the turbines here, 43% was sand, which
 4 should never happen.
 5 And the desanders also had a hydraulic roller that
 6 was vertical. The water would come in, go to the bottom
 7 and then come back up again, which we again discussed
 8 yesterday.
 9 So the objective of this project, which was
 10 World Bank-financed, was to modify and correct a number
 11 of deficiencies so that this project would operate
 12 better. But here's a project on a river twice the
 13 sediment load of the Chenab, surface intake, sluicing,
 14 and it works.
 15 And the operating rule is like this: the sediment
 16 concentration goes up as soon as you drop the level
 17 down, because it now starts to flow as a river. During
 18 the wet season, the desanders are operating to take out
 19 sediment. During the dry season, you don't even have to
 20 use them because there's basically no sediment in the
 21 river. If you've seen Himalayan rivers in the winter,
 22 they're beautiful: they're just crystal-clear,
 23 beautiful. So in the load on this project, the sediment
 24 load would fill the reservoir with sand within a couple
 25 of months in the monsoon. So it handles a large load.

Page 38

10:33 1 (Slide 45) Now, another example, to move to the
 2 other end of the scale, is Three Gorges in China,
 3 22,500 MW, the largest hydropower plant in the world.
 4 And they have a sediment load of 400 million tonnes.
 5 The reservoir is about 660 kilometres long.
 6 And they have an operating rule again based on
 7 a sluicing process, whereby it's a multipurpose
 8 reservoir, but basically during the flood season, which
 9 is in the summer in China, you have the water level at
 10 a low level for two purposes: (1) to sluice sediment, to
 11 establish an equilibrium profile. The original studies
 12 indicated that this profile would be established after
 13 and be fully stabilised within 100 years. They have
 14 been revising the rule and optimising the project
 15 operation. But they operate this year-round.
 16 So, smaller project, larger project, you can do
 17 this.
 18 (Slide 46) Now let's take a comparative look at
 19 flushing. What you do when you flush -- in the drawing
 20 here you can see: this is your minimum operating level,
 21 the dotted line -- you stop the turbines and then you
 22 draw the reservoir down.
 23 And your rate of drawdown depends on two things:
 24 the dam. If it's an earthen dam, your drawdown rate
 25 will be low, because it will create instability within

Page 39

10:35 1 the dam if you draw it down quickly. It also depends on
 2 the stability of the banks. Because when the reservoir
 3 is up high, of course, all the rock and soil surrounding
 4 the reservoir is full of water, and if you drop that
 5 rapidly, this water, as it drains out, so to speak, the
 6 pressure will cause, or can cause, collapsing of the
 7 sides of the reservoir.
 8 So you have a drawdown rate.
 9 Then you get the reservoir empty and you have
 10 a period of flushing. And as the sediments remove, the
 11 water level can gradually go down, and then you have to
 12 refill the reservoir and then you can restart the
 13 turbines. But of course at the end of this flushing
 14 event, you will also have to be releasing some water
 15 downstream. You're not going to empty the river: you're
 16 not going to turn the gates off and the fish will be out
 17 there flopping on the ground.
 18 So this whole process takes time, and it's time that
 19 the turbines will not be operating. As I mentioned, in
 20 the case of Tarbela, it was a minimum of 30 days.
 21 The flushing events, because they do release a lot
 22 of sediment in a short period of time, you will
 23 typically have to deploy -- under the procedures, you
 24 will have to deploy a mitigation and monitoring team.
 25 Depending on your regulatory environment, you may have

Page 40

10:36 1 a rather large team: you may have 50 people in the
 2 field. And you may have follow-up activities,
 3 et cetera.
 4 (Slide 47) So the procedure is schematically
 5 illustrated here, where the river enters the reservoir,
 6 picks up sediment and delivers the sediment downstream,
 7 and this concentration of the sediment in the water is
 8 typically in excess of 100,000 milligrams per litre.
 9 When we did Warsak, which is an Indus distributary that
 10 comes out of Afghanistan instead of coming out of
 11 Kashmir, we hit concentrations of 130,000 milligrams per
 12 litre. So the second flushing we did, we lowered the
 13 rate of decline so we could control the maximum
 14 concentrations, which of course elongates your flushing
 15 period.
 16 So you're going to be limited in your drawdown rate
 17 not only by the reservoir and by the dam conditions, but
 18 also by the sediment concentration that you can release
 19 downstream.
 20 100,000 milligrams per litre will kill most things
 21 in the river, if it's sustained. And if you have
 22 a downstream filter plant, it's not going to be
 23 operable. If you have downstream irrigation canals,
 24 they will fill with the sediment, the canals will fill
 25 with sediment. So there's a lot of things to consider

Page 41

10:39 1 cascade has certain advantages and certain
 2 disadvantages.
 3 The thing I had mentioned previously on the bottom
 4 right-hand, here on slide 48, is: the flushing channel,
 5 the width will be limited. And in the bottom left-hand
 6 corner of that graphic, you can see the -- it's
 7 a regime-type equation that was basically worked out for
 8 reservoirs in primarily silty sediments; it's from
 9 China.
 10 There's an article by Kantoush in Japan looking at
 11 Japanese reservoirs which have more gravel: the channel
 12 will be about half this width.
 13 But the end message here is that channel width is
 14 limited. So if you have a tall reservoir, very wide,
 15 your flushing channel is going to be limited.
 16 And finally, because we have the problem of having
 17 the sediment load concentrated in time, it can produce
 18 a lot of downstream consequences. And one of the
 19 reasons that flushing in many jurisdictions is basically
 20 infeasible is because of downstream impacts.
 21 (Slide 49) Here, just giving an example, the
 22 regulatory guidance letter from the US Corps of
 23 Engineers (P-612), which I think has been introduced
 24 into the record. It basically makes a differentiation
 25 between sluicing and flushing.

Page 43

10:38 1 here. It's not just: we'll open the gates and the
 2 problem is solved.
 3 (Slide 48) When we talk about capacity preservation
 4 by flushing, when you flush through a cascade -- when
 5 you have a cascade, you need to flush through the
 6 cascade. It doesn't really help you a lot if you're
 7 going to flush out of one reservoir and then just
 8 deposit it in the next one downstream. You need to take
 9 advantage of the operation. So you're going to probably
 10 be having all of these reservoirs out of service at the
 11 same time. Which, as I mentioned, was why we looked at
 12 dredging at Tarbela, because if we were to release
 13 sediment from the upstream reservoirs, taking the plants
 14 out of service, Tarbela can remain in operation.
 15 Also if you have an upstream dam, you can control
 16 releases, and therefore create artificial flushing flows
 17 for the downstream dam. For instance, along the Chenab,
 18 India has proposed the Pakal Dul storage dam upstream.
 19 And that can be used for two things: it can be used to
 20 generate the flows that will pass through all the
 21 downstream run-of-river plants, basically using the
 22 storage plant as a big pondage pool; and also you can
 23 generate flows for sediment management downstream.
 24 So being able to control the downstream hydrology
 25 is, of course, an advantage of a cascade. So the

Page 42

10:41 1 Now, in the United States, if you have to get
 2 an Army Corps of Engineers permit, that is like the
 3 worst thing that can happen. Basically, it's a permit
 4 that involves all your federal agencies and typically
 5 goes through all of your state agencies also. So all
 6 the agencies have to get on board and agree with what
 7 you're going to do, including National Marine Fisheries,
 8 Fish and Wildlife Service, Environmental Protection
 9 Agency, plus all of your local agencies. And there's
 10 also a public review process. So you have a lot of
 11 fingers in the pie, and it's a difficult, time-consuming
 12 and costly process.
 13 Sluicing is exempted. It's exempted because -- look
 14 at the bottom. I think it got cut off when they
 15 reformatted this, but it says "sluicing structures that
 16 mimic the natural increase ... of sediment in a stream",
 17 where the sediment that's discharged through the
 18 structure basically follows the natural pattern, is
 19 exempted from having to get the permit. Because this is
 20 basically a dredging permit. Flushing is considered to
 21 be dredging; sluicing is not, because your sluicing is
 22 trying to mimic the natural pattern.
 23 So to have a prohibition against flushing is
 24 actually not unusual.
 25 (Slide 50) Now, let's talk about dredging real

Page 44

10:43 1 quick.
 2 This is the Bajo Anchicayá project in Colombia, and
 3 I worked on this project about ten years ago. It's
 4 a small 74 MW project. It's on the Pacific drainage of
 5 Colombia. And they had a flushing event, and it created
 6 a lot of downstream problems in terms of social issues.
 7 There are some very special social issues in this area:
 8 there are indigenous tribes which have a lot of
 9 protection in Colombian law, et cetera. So they were
 10 faced with regulatory actions, lawsuits, and this is
 11 still ongoing after decades.
 12 But they started dredging here in 1962. This is, as
 13 far as I have seen anywhere in the world, the longest
 14 continuous dredging project in any reservoir. They've
 15 been continuously dredging since 1962. And the
 16 interesting thing is that if you compare the amount
 17 dredged here per year -- and they use two dredges.
 18 You can see this is a suction cutter-head dredge
 19 that discharges into a tunnel right about here
 20 (indicating), just upstream of the dam, which discharges
 21 just below the dam. And not visible in the photograph,
 22 but upstream, is what they call a Sauerman dredge, which
 23 is like a dragline. But it's not a dragline that's on
 24 a tracked vehicle: it's a permanently installed dragline
 25 that goes out, collects sediment, and dumps it also into

Page 45

10:44 1 the same tunnel. So the dragline picks up the larger
 2 material -- gravels and cobbles -- and the cutter-head
 3 dredge picks up gravels and sand.
 4 The dredging quantity of 528,000 cubic metres
 5 a year, divided by your 74 MW, gives you something like
 6 7,000 metres per MW, or some number like that. If you
 7 apply that to the 900 MW Baglihar plant, this converts
 8 into something on the order of about 9 million
 9 cubic metres a year of dredging. And if you look at the
 10 overall sediment load from Baglihar, you're talking
 11 about being able to -- this is equivalent to having
 12 a dredge in Baglihar which would dredge something like
 13 40% of the total inflowing load. And of course, part of
 14 your load is going to go through your turbines anyway,
 15 and part of the load is going to go over the dam when
 16 you have the big flood.
 17 So everybody says dredging is not feasible, but
 18 here's an example where it is feasible. And
 19 I explained: even on very large scale, it is an option,
 20 and even in the Himalaya.
 21 (Slide 51) So to close this part of the discussion,
 22 dredging, sluicing, flushing: a lot goes into taking
 23 into account the production cost and the cost of forgone
 24 production of power and the downstream impacts. If you
 25 have dispatch availability and problems with your PPA,

Page 46

10:46 1 your power purchase agreement -- it's a contract for the
 2 sale of power, and that will typically have obligations
 3 to deliver; and if you don't deliver, you may have
 4 additional cost that you have to pay. And these other
 5 factors, plus all the downstream costs, all factor into
 6 the decision of whether or not to flush, how to do it,
 7 and how to draw the reservoir down and how to move the
 8 sediment downstream.
 9 Dredging does not require interruption of power
 10 production. Sluicing minimises the interruption of
 11 power production. Flushing does require emptying:
 12 a rather prolonged shutdown of the power plant. And you
 13 also have the problem of the downstream sediment
 14 release.
 15 (Slide 52) So your selection of a sediment
 16 management strategy depends on your site hydrology; your
 17 physical features: site, sediment load; your drawdown
 18 rate; the plant head; the type of turbine that you're
 19 going to be using; how quickly you can repair it. And
 20 it also depends on your socioeconomic environment: your
 21 legal, your regulatory environment, which is especially
 22 relevant to flushing; the sensitivity of the downstream
 23 environment; the slope of the river; can the sediment be
 24 transported; ecological richness.
 25 Spawning beds: you release sediment into spawning

Page 47

10:48 1 beds, the sediment will accumulate in the spawning
 2 gravels, and that blocks the flow of oxygenated water
 3 where the fish lay their eggs. For instance, a salmon
 4 lays eggs in gravel; the gravel gets coated with
 5 sediment; the eggs will die because there's no oxygen.
 6 Social sensitivity to sediment downstream. And
 7 downstream infrastructure: canals, intakes, et cetera.
 8 (Slide 53) Now, I would just like to close this
 9 section with making a couple of comments on climate
 10 change. I know that that's of interest here. And
 11 I would just like to point out that when you design in
 12 this environment, you're thinking about climate change.
 13 And in the projects that I've worked with in the
 14 Himalaya, and especially bank-financed projects, climate
 15 change is always a big deal. But there's a couple of
 16 things here.
 17 When you look at design, you have years of high
 18 sediment load and low sediment load, and you design for
 19 the high loads. So if your climate is going to change
 20 your sediment load, you're already designing for high
 21 load. You don't design a project saying, "Well, the
 22 sediment load is always going to be average", because
 23 it's not.
 24 The Treaty doesn't allocate water: the Treaty
 25 allocates watersheds. So we had discussions of: how

Page 48

10:49 1 could we change the Treaty to make it more
 2 "climate-sensitive", let's say. And what you really see
 3 when you look at that is: the Treaty apportions
 4 watersheds, and India gets certain watersheds and
 5 Pakistan gets certain watersheds. So within that
 6 context, it's not obvious how you could do anything
 7 to -- quote-unquote -- "modify", "alter", "reinterpret"
 8 the Treaty to manage climate change in a different way,
 9 especially since both of the parties will probably have
 10 very similar climate impacts.
 11 As was described yesterday, we're not clear exactly
 12 what those impacts are going to be across their full
 13 spectrum, but we do know that it will increase -- and is
 14 increasing -- the demand for irrigation. More heat,
 15 more evapotranspiration from the plants, more irrigation
 16 demand. So that part is pretty certain. The part
 17 that's uncertain is the precipitation patterns in the
 18 mountains, which is unfortunately an area which has
 19 rather a paucity of historical data.
 20 So basically that's, in a nutshell, what I would
 21 like to say at this point about climate change. Like
 22 I said, I've given it a lot of thought. And it seems
 23 that the Treaty, the way it's set up, apportioning
 24 watersheds, basically is -- how would you say? -- it's
 25 equitable, in a way, even when climate change comes down

Page 49

10:53 1 About half of my work is remedial work with plants
 2 that have problems, and what we see repeatedly is that
 3 people just weren't thinking, they weren't cognisant.
 4 It's something that they aren't really accustomed to
 5 working with, because you go to school and you learn
 6 about steel and concrete and hydraulics, but sediment
 7 isn't in the regular curriculum. So it's something
 8 that, when you put your mind to it, you can solve it.
 9 Where there's a will, there's a way.
 10 Both methods, sluicing and flushing, have advantages
 11 and disadvantages. And I would also like to say that
 12 a lot of progress has been made in the recent decades in
 13 the areas of coatings and better understanding how to
 14 management sediment. From when I started working in
 15 this field to today, huge advances have been made.
 16 So I would just like to close by saying that a lot
 17 of options are available, and we are not locked into
 18 "This is the way to do it".
 19 So with that I will close, and maybe there's more
 20 questions.
 21 THE CHAIRMAN: Professor Buytaert.
 22 (10.54 am)
 23 Questions from THE COURT
 24 PROFESSOR BUYTAERT: Thank you very much, Dr Morris. Again,
 25 a very clear presentation. I've got a few questions.

Page 51

10:51 1 and affects this, because both parties are going to have
 2 similar types of problems to deal with.
 3 It does make it clear though that the Treaty is
 4 focused on sustaining the hydrology coming into
 5 Pakistan. And if there is a change in that hydrology,
 6 it doesn't change, let's say, the obligation or the need
 7 for Pakistan to receive the waters as it naturally comes
 8 down.
 9 (Slide 54) So just to conclude. I hope I have been
 10 able to have you understand that there's a lot of ways
 11 of focusing and solving sediment issues. In English,
 12 we'd say there's -- I mean, American; I don't know if
 13 it's an expression over here -- but there's many ways to
 14 skin a cat. There are many ways to approach a problem.
 15 And sluicing and flushing are both viable methods, no
 16 doubt about it. And they can both work in the Himalaya,
 17 and I have worked on projects on both ends of the
 18 spectrum.
 19 I should mention that I showed you that table at the
 20 beginning with all the different methods: in my
 21 professional career, I have worked with all of them at
 22 different projects in different locations. So I'm not
 23 here to say, "This is the way to do it", or, "This other
 24 way is the way to do it". There's a lot of things that
 25 can be done, there's a lot of options.

Page 50

10:54 1 My first one relates to this concept of
 2 weaponisation of infrastructure: essentially, call it
 3 the on-purpose management of infrastructure to create
 4 downstream harm, which is a concern in this context.
 5 It has been brought up mostly in the context of India
 6 switching off the water towards Pakistan.
 7 But from a sediment perspective, can you think of
 8 any scenarios where sediment is managed in such a way
 9 that it might create substantial downstream harm?
 10 DR MORRIS: Water and sediment travel at different
 11 velocities down a river. And when we've looked at this,
 12 the principal problem for Pakistan will -- we expect it
 13 to be the interruption of supply.
 14 There's a second problem: that because the dams
 15 have -- for instance, Baglihar has very large gates, you
 16 can pass large, large floods, and you can open those
 17 gates and create flood conditions downstream. But when
 18 we've looked at the flood-control capacity of the
 19 downstream barrages in Pakistan, it looks like we have
 20 the capacity to manage the flood.
 21 So the flood is an issue which is not as worrying as
 22 the interruption of supply. Because if you can imagine
 23 running an irrigation system where you have three or
 24 four weeks of no water, and then all of a sudden it all
 25 comes in a spike, and then you have another two or

Page 52

10:56 1 three weeks with no water, you're not going to be
 2 successful in your irrigation scheme.
 3 The third that you mentioned here is sediment. Now,
 4 the sediment, when it's released, it will flow
 5 downstream. But in the case, for instance, of the
 6 Chenab, the sediment will go through the Salal project
 7 in India first. So the Salal project in India would be
 8 the very first to be impacted and would receive the
 9 biggest impacts of any downstream infrastructure.
 10 So it seems that, yes, the sediment -- well, let me
 11 go back a little bit.
 12 As the sediment is released, it tends to deposit on
 13 the riverbed. And what we've seen in the experiments at
 14 Warsak, we monitored bridges at different distances from
 15 the dam, up to, I think it was, about 35 kilometres
 16 downstream, and the sediment concentrations decreased
 17 going downstream. Because sediments are being
 18 deposited, basically, on the riverbed; some of it goes
 19 into your irrigation canals.
 20 So the sediment arriving in Pakistan will probably
 21 be the number three problem, rather than the number one
 22 problem. The number one problem is the interruption of
 23 the water supply; number two is the flood. And of
 24 course the interruption means you'll have, like, zero
 25 flow or a greatly reduced flow and then a peak, and

Page 53

10:59 1 dam was completely destroyed. Completely destroyed:
 2 it's gone. And people died downstream. And it was not
 3 the only event; there was another event, I think, in
 4 2013 that affected another area of the Himalaya.
 5 And we have problems of that type in Nepal, for
 6 instance. I don't have it in this presentation, but
 7 I've got a picture of one of the landslide lakes in
 8 Nepal that severely damaged and completely inundated
 9 a couple of small run-of-river plants.
 10 So, yes, it's a problem. But you also have to
 11 understand that a lot of the problems have occurred
 12 because people have not paid attention to it. You need
 13 to do a proper mapping of what's upstream, and you may
 14 find that there are certain areas that just basically
 15 aren't good areas to do hydro projects because of that
 16 specific danger.
 17 If you do a concrete dam, it can get overtopped,
 18 then you can maybe work your way out of it, but it's
 19 costly. If you're a government, maybe you can afford
 20 it, maybe you can find the money to do it. If you're
 21 a private entity, maybe it will be more difficult.
 22 But it's a problem that can be addressed through
 23 proper design. And part of the design question is: do
 24 I really want to put a plant in the area where I have
 25 such a large risk?

Page 55

10:57 1 then -- you know, there is the potential to do that. So
 2 it's interruption of supply; number two would be
 3 flooding; and number three would be the sediment
 4 release. And particularly because, on the Chenab in
 5 particular, India would be more affected: they would be
 6 basically inundating their own plant with sediment.
 7 PROFESSOR BUYTAERT: Thank you very much.
 8 Another question relates to the last point you
 9 mentioned on climate change. I believe you mentioned
 10 yesterday GLOFs and LLOFs, which do occur in mountainous
 11 environments, including the Himalayas, and are likely to
 12 increase in intensity and frequency under conditions of
 13 climate change.
 14 So far, how big has the impact of GLOFs and LLOFs
 15 been in managing dams and reservoirs in this region?
 16 And what is your view on the potential increase in risk
 17 as a result of climate change and changing environmental
 18 conditions more generally?
 19 DR MORRIS: If you read some of the information that comes
 20 out in the media, you will know that some of the Indian
 21 projects -- some large Indian projects, in fact -- have
 22 been impacted.
 23 There was a project on the Teesta River which was
 24 impacted by -- I can't remember if it was a GLOF or
 25 a landslide lake flood. But a 1,200 MW project. The

Page 54

11:00 1 Again, one of the slides that's not in the
 2 presentation here is the Jagran plant in Kashmir, in
 3 Pakistan, 30 MW, which was affected by a debris flow.
 4 You had boulders coming over the dam. But in this case
 5 it was designed for this type of event. You have a low
 6 dam, an ungated crest spillway. And then, looking
 7 downstream, on the left-hand side you have a couple of
 8 sluice gates in front of the intake. Just pure
 9 run-of-river; they don't have pondage at this plant.
 10 And the event came through; the sediment, including the
 11 boulders, went over the spillway. They came back with
 12 a bulldozer, cleared out the area in front of the
 13 intake, and the plants are ready to go to work again.
 14 Unfortunately, their switchyard was placed too close
 15 to the river and the switchyard got wiped out, along
 16 with a mosque that had been there for 120 years. So it
 17 was an extraordinary event. But the dam was not
 18 materially damaged; and of course the powerhouse, which
 19 was an underground powerhouse, was completely intact.
 20 So you can design for this.
 21 PROFESSOR BUYTAERT: Thank you, I think that's a very
 22 helpful example. More generally, would you design a dam
 23 very differently if you knew that GLOFs and LLOFs were
 24 a substantial risk?
 25 DR MORRIS: Yes, you have to understand what your risks are

Page 56

11:02 1 and you have to plan for them and you have to design for
 2 them.
 3 Like I had said at the beginning, engineering is
 4 a very fascinating profession. Every project is its own
 5 little problem, or big problem: your physical factors,
 6 your problems with regulatory limitations; there's all
 7 types of things. But you put your mind to it and the
 8 solutions will come up. But there are sites that you
 9 shouldn't build on.
 10 PROFESSOR BUYTAERT: Thank you.
 11 My last question is a bit more conceptual in nature.
 12 If you have a valley with hydropower potential and
 13 you're looking for installing a certain capacity, and
 14 you have the option between fewer large plants or more
 15 smaller plants -- and obviously there are many
 16 considerations that would influence that decision -- but
 17 from a sediment perspective, would you be able to say:
 18 well, we'd rather go for fewer large plants or more
 19 smaller plants? Is there a general trend towards which
 20 of those is easier to manage from a sediment
 21 perspective?
 22 DR MORRIS: That's a question that doesn't have really
 23 a good answer. You can, of course, management sediment
 24 appropriately in either case.
 25 In general, the larger plants tend to be less costly

Page 57

11:05 1 typically at the point of, "This is where you want to
 2 build it"; maybe not at this exact spot, but move it up
 3 and down a kilometre, or something like that. You've
 4 got a general idea of where you want to put it.
 5 PROFESSOR BUYTAERT: Thank you very much. I certainly did
 6 not expect a straightforward answer. But your views are
 7 very, very helpful nevertheless. Thank you.
 8 THE CHAIRMAN: Mr Minear.
 9 MR MINEAR: Dr Morris, thank you for your presentation.
 10 I have a question related to Dr Buytaert's first
 11 question about sediment management.
 12 As I recall, Neelum-Jhelum is downstream from
 13 Kishenganga. Would sediment management at Kishenganga
 14 affect the operation of Neelum-Jhelum?
 15 DR MORRIS: Yes, because Kishenganga is currently
 16 accumulating sediment. In our office, we simulated
 17 Kishenganga, what, 15 years ago, as part of the first
 18 case, and at that time we were anticipating that it
 19 would come into sediment balance after more or less
 20 40-50 years, something in that range; I don't remember
 21 the exact number.
 22 But Kishenganga is quite a distance upstream of
 23 Neelum-Jhelum. So with respect to the bed load, bed
 24 material, you will not see it at Neelum-Jhelum, you will
 25 not be able to measure it. With respect to suspended

Page 59

11:03 1 on a per-megawatt basis. Maybe even, if you compare
 2 a 1,000 MW versus a 20 MW, you're maybe looking at half
 3 the cost per megawatt. But your 1,000 MW plant, you're
 4 looking at \$1.5 billion: that's a big nut to crack. And
 5 if you have a problem -- for instance, the one
 6 I mentioned in the Teesta River, where they have
 7 a 1,200 MW plant, the dam is gone -- you have a lot of
 8 investment in one project.
 9 So I don't think that there is what you could call
 10 a good answer to that. My preference, if I was going to
 11 work on it, if I was given a pristine river, I would
 12 select plants which are probably moderate in size.
 13 I would not try to do a 3,000 MW plant to do the whole
 14 river, and I wouldn't certainly do 30/20 MW plants.
 15 Either extreme is probably too extreme. But I know it's
 16 not a really good answer.
 17 But the other thing is that as an engineer, you're
 18 never given a river: you're typically given a segment of
 19 a river or a site. And the planning stage in many of
 20 these rivers was done many years ago, like 60 years ago.
 21 And maybe the question is: should we replan this, based
 22 on, for instance, high dam/short tunnel, versus low dam
 23 and longer tunnel? Those types of questions, which are
 24 more overall questions.
 25 But by the time your design engineer comes, it's

Page 58

11:07 1 load, you may see something, but it is only a portion of
 2 the entire watershed. And so the sediment management at
 3 Kishenganga will probably not have an appreciable or
 4 significant impact.
 5 It may have a measurable impact, if we had good
 6 measurements. But in this part of the world, we don't
 7 have, like, United States Geological Survey quality
 8 stations that have been running data for 30 years. We
 9 don't have that. So it would be difficult, within all
 10 the variability that we see, to pick out, "Well, this is
 11 what the condition was before Kishenganga, and this is
 12 the condition after". So it's probably not something
 13 that they would be able to even measure at this point.
 14 So, yes, from the standpoint of sediment -- water is
 15 completely different. But from the standpoint of
 16 sediment, probably not much impact. And if there is,
 17 it would be a reduction in sediment for the next several
 18 decades.
 19 MR MINEAR: Thank you.
 20 THE CHAIRMAN: Dr Morris, you mentioned the possibility of
 21 cascades of dams in the context of sediment management.
 22 And I was wondering if you could step back from the
 23 sediment control context and just say something about
 24 whether there are inherent limits on the building of
 25 a cascade of dams in the Himalayas.

Page 60

11:08 1 And by that I mean: are there reasons why at
 2 a certain point you can't continue to do a cascade, for
 3 reasons of sediment but also just hydrology? Or is it
 4 the case that you can design these dams in a way that
 5 you can have almost an unlimited number on the same
 6 river system?
 7 DR MORRIS: You can design them as a stair step, where the
 8 tailwater of one falls at the powerhouse of the next
 9 upstream dam. There's no physical limitation to doing
 10 that.
 11 Of course, you have limitations in terms of where
 12 you're going to place dams because you have existing
 13 communities. So you have to work around -- you don't
 14 want to flood communities. And if you have a cascade of
 15 dams, you're going to have flooding everywhere along the
 16 river. So that's our number one constraint. And it's
 17 not just the communities on the main stem: you have
 18 tributaries. So it's the main stem plus whatever
 19 tributary communities you have.
 20 The second limitation is going upstream. You get to
 21 a point higher in the watershed where you have less
 22 water, you have more risk of GLOF events, landslides,
 23 all types of risks. And this is just characteristic of
 24 working in mountains: you get to a certain elevation,
 25 and it becomes so difficult that it doesn't make any

Page 61

11:10 1 sense. You have access problems, et cetera.
 2 So basically, your limitations are riverside
 3 communities in the downstream section; and you reach
 4 an area upstream where you just have too much risk, too
 5 much cost, too many geologic problems, et cetera.
 6 THE CHAIRMAN: Very good. Thank you very much.
 7 I don't think we have any further questions, so let
 8 me just thank you very much for your presentation.
 9 It was very helpful.
 10 I think we are now at a time where we might take our
 11 coffee break. So why don't we return at 11.40. And at
 12 that point we will resume, I take it, with Mr Rae.
 13 SIR DANIEL: That's correct. Thank you, Mr Chairman.
 14 THE CHAIRMAN: Thank you very much.
 15 (11.11 am)
 16 (A short break)
 17 (11.41 am)
 18 THE CHAIRMAN: Okay, I think we are reassembled. So,
 19 Mr Rae, whenever you're ready, please proceed.
 20 Incorporating a Run-of-River HEP
 21 in an Integrated Power System
 22 MR RAE: Mr Chairman, members of the Court, I'm pleased to
 23 be able to speak to you today about this topic. I'm
 24 going to present the Court with some background on the
 25 operation of run-of-river hydropower projects in

Page 62

11:41 1 an integrated power system.
 2 (Slide 2) The objective today is to explain power
 3 systems in general, and how a run-of-river hydropower
 4 project is used in that power system. I will also
 5 comment on the evolution of power systems and power
 6 generation, especially the recent trend to solar and
 7 wind resources and the associated role and operation of
 8 hydropower with the integration of those resources. My
 9 purpose here is to provide a general grounding in
 10 hydropower operation, which will become more relevant to
 11 you as we proceed through the week. (Pause)
 12 In slide 3, I'm going to discuss four main topics.
 13 Firstly, an overview of the characteristics of
 14 an integrated power system in general, looking at global
 15 growth in electricity generation, and then the specifics
 16 of the system in India.
 17 I'll then discuss some of the general aspects of
 18 generation expansion planning for a power system, and
 19 this is to determine how we get to select the plants
 20 that we actually design for a system.
 21 The use of run-of-river hydroelectric power will be
 22 illustrated with respect to the services they provide
 23 for the power system and some of the limitations they
 24 have in those systems.
 25 Then my final section concerns the ongoing evolution

Page 63

11:43 1 of power systems to integrate the other renewable energy
 2 sources. These energy sources are very important and
 3 they require significant system supports to enable
 4 effective dispatch.
 5 (Slide 4) So firstly now, we'll go on to the power
 6 system in general.
 7 In slide 5, just as a bit of a background for
 8 interest's sake, I illustrate the growth in primary
 9 energy in demand in the world from 1800 to the present.
 10 What you see here is primary energy demand, which is the
 11 total energy used before transformation, whether for
 12 electricity or waterpower or mills or whatever. This is
 13 the total energy consumed.
 14 The energy demand globally shows the transition
 15 through a series of industrial revolutions, which
 16 started in the middle of the 18th century and has
 17 continued to the present. The most rapid growth in
 18 energy demand starts from the beginning of the
 19 20th century and accelerates significantly from the
 20 1950s.
 21 So going on, looking at electricity demand. It's
 22 a similar pattern shown in slide 6. And it also shows
 23 the main sources of energy, which you see on the right
 24 side of the slide there.
 25 Electrical energy itself is a relatively recent

Page 64

11:44 1 development in the arc of human history. The first real
 2 commercial developments of any scale date to the late
 3 19th and beginning of the 20th century.
 4 I'd like to appreciate this by considering that my
 5 own grandparents were born within a couple of years on
 6 either side of the turn of the 20th century, so that the
 7 lifetime of global electricity use that we look at now
 8 is within the span of three generations. Hopefully
 9 I will continue for a while longer!
 10 But electrical energy demand has grown in parallel
 11 with the global energy demand shown in the previous
 12 slide. There have been significant advances in the
 13 technology for electric power generation in this period,
 14 with associated improvements in efficiency and
 15 cost-effectiveness. And similarly, the end uses for
 16 electric power generation have changed dramatically,
 17 both in the range of uses but also in the pervasiveness
 18 of electricity in our lives.
 19 Note that global hydropower production has grown
 20 slowly relative to the growth in other sources, and this
 21 is evident in this slide that's in front of you. The
 22 usage of some of the thermal fuels has recently started
 23 to drop off: it's not growing as rapidly. And recently
 24 there has been a dramatic and significant growth in
 25 other renewable energy sources, which you see as the

Page 65

11:47 1 period. This is pointing out that the total generation
 2 of course has grown very rapidly; but the majority of
 3 the growth historically has been in thermal fuels. This
 4 has been coal, largely, in India, but to some degree
 5 other fuels as well.
 6 An important thing to see in the slides is the
 7 recent growth of renewable energies that have grown
 8 dramatically within the last decade, and the more
 9 gradual growth of hydro over the period of time
 10 illustrated here. The other renewables, shown as the
 11 green line in the figure, are now increasing in the
 12 range of 10-15% per year. Again, there is the
 13 Indus Waters Treaty early in that process.
 14 Going on to slide 9, I wanted to illustrate the
 15 difference between the installed capacity and the energy
 16 generation by source in India as of 2023. It's
 17 important to recall here that there's a very important
 18 difference between installed capacity, or what we refer
 19 to as "power", and the energy produced using that
 20 capacity. They are two entirely different things.
 21 Capacity in the system is shown in the figure on the
 22 left, and energy is in the figure on the right. So
 23 looking at the capacity first of all, I know the figures
 24 below are not all that clear. (Pause)
 25 The thermal fuels is typically in black on the

Page 67

11:46 1 orange colour at the top of the slide.
 2 But that said, the core product of the power system
 3 has not changed from its earliest development under the
 4 direction of innovators such as Edison, Westinghouse or
 5 Tesla. Power systems still operate to provide
 6 electricity at a fixed voltage and frequency. So the
 7 energy production itself has evolved, but the underlying
 8 physics of electricity is fundamentally the same.
 9 And you'll note here, I've highlighted on the slide
 10 the date of the Indus Waters Treaty, which is early in
 11 the development of hydropower, but that doesn't change
 12 how the energy envisaged in that Treaty was involved.
 13 (Slide 7) So from that general background, we can
 14 then look at: well, what's the situation in India?
 15 Well, India has also seen a rapid growth in energy
 16 generation, which is the orange line to the bottom of
 17 the figure, which shows a rapid growth from the
 18 mid-1940s to where we are today. And this is associated
 19 both with an increasing population but also the
 20 increasing consumption of energy per capita, which is
 21 what you would expect from an industrialising or
 22 developing nation. So you have an energy growth on both
 23 counts.
 24 Then the next slide, slide 8, shows how we get the
 25 historical energy generation in India for the same

Page 66

11:49 1 figure, and they account to about 57% of the capacity of
 2 the system. Of the thermal fuels, there is largely coal
 3 and you have some gas, you have some oil and you have
 4 some diesel use. They're about 57% of that figure on
 5 the left.
 6 When you come to the energy produced in the system,
 7 which is the figure on the right, the thermal fuels then
 8 make up almost 75% of the energy generated in India.
 9 The light blue colour, which is on the lower-right
 10 side of the left figure, is the amount of generation
 11 from solar. And the capacity of solar in India now is
 12 about 30% of the total capacity of the system, which now
 13 makes up about 12% of the total energy being produced.
 14 The hydro is the darker blue colour, and it
 15 comprises about 11% of both the capacity and the energy.
 16 It's important to understand what's in the system so
 17 we have a better appreciation for how these plants will
 18 be operating in that overall system.
 19 One of the difficulties with the solar and wind
 20 sources is their intermittent nature and the need to
 21 provide dedicated energy storage to allow the available
 22 energy to be dispatched during the evening hours.
 23 Again, although the renewables capacity may be 30%; the
 24 energy is that smaller component. Then issue then is:
 25 how do we get that energy dispatched in the system?

Page 68

11:51 1 So along with the solar capacity, there is dedicated
 2 energy storage required in these systems: you have to
 3 have some way of storing the solar that's generated.
 4 And that has led to a growth globally in the use of
 5 batteries. Around the world, the largest amount of
 6 energy storage for solar is with batteries at this
 7 moment.
 8 India also has plans to implement a large programme
 9 of pump storage development that will provide energy for
 10 solar implementation. CEA lists 57 GW of pump storage
 11 projects, several of which are now in final planning or
 12 construction.
 13 So overall, the Indian system is the third largest
 14 in the world, and is large relative to the power
 15 stations that we're discussing on the Indus Waters. For
 16 example, the Baglihar Hydropower Project, with
 17 a capacity of 900 MW, is only 0.2% of the installed
 18 capacity in India.
 19 So a word about system interconnection. And this is
 20 shown in slide 10, where we show the regional power
 21 grids in India. There's five interconnected regional
 22 power grids: the northern, northeastern, eastern,
 23 southern and western. The figure there shows the
 24 general geographic area of those power grids. The
 25 interconnected system allows the power stations to work

Page 69

11:52 1 in a complementary manner to supply the overall demand.
 2 But historically, if we go back into the early part
 3 of the 20th century, electricity development had many
 4 isolated grid systems where a plant would serve a single
 5 industrial user or a small utility grid. These isolated
 6 grid systems have largely been replaced around the world
 7 as power systems and have become more integrated and
 8 extended their capability through transmission.
 9 So the northern grid region here includes the
 10 Indus River basins, the tributaries in Jammu and
 11 Kashmir, as well as other basins not covered by the
 12 Treaty. This region is fully interconnected with the
 13 other regional power grids in India.
 14 And as I point out in the pie chart here, the
 15 northern region has an installed capacity of about
 16 100,000 MW. So it's not a small system; it's quite
 17 large. In proportion to the total -- each of the grids
 18 are a similar size, but you see an idea of how large
 19 they are here.
 20 Interconnection is important in that it provides
 21 system diversity that reinforces the capabilities of the
 22 renewable energies and supports the provision of power
 23 system ancillary benefits. And I'll come to those in
 24 a few moments. The interconnections also affect how
 25 hydropower and other energy resources are utilised in

Page 70

11:54 1 meeting system demands.
 2 It's also interesting to observe that making
 3 a transition from isolated to integrated grids has made
 4 some projects possible where previously there would not
 5 have been sufficient demand. An example would be
 6 a remote watershed where there might have been a project
 7 available, but there was no demand locally for it, and
 8 that would have constrained the ability to develop that
 9 project. We are now in a world where we have integrated
 10 these to such a degree that we're able to develop remote
 11 watersheds. And the Indus Basin comes into
 12 consideration in this respect as well.
 13 Each of the grids that we see regionally here is
 14 managed by a system operator, and they determine the
 15 daily dispatch of generating plants to meet the demands.
 16 So they work day by day to determine who's on and who's
 17 off.
 18 (Slide 11) So with that general overview, I'd now
 19 like to give some comments or a very brief introduction
 20 to how power stations are actually planned.
 21 In slide 12, I give a diagram here which gives
 22 a very simplistic description of what goes into
 23 a generation expansion planning exercise.
 24 The purpose of the planning is to determine the
 25 optimal mix of new power stations that will satisfy

Page 71

11:56 1 technical and financial constraints. The process
 2 includes identification of a power and energy demand
 3 forecast, what is it we're trying to achieve, and this
 4 is generally tied to an economic growth forecast of its
 5 own.
 6 It's then followed by an assessment of the available
 7 resources: what can be produced in terms of fuels,
 8 hydropower, solar or whatever. They all go into
 9 a basket to be identified.
 10 We then go through a process of selecting the
 11 technologies, and balancing the supply and demand so
 12 that we add enough power stations to meet the demand
 13 that's arriving from the forecast.
 14 This then goes to the next step of, with the
 15 available projects, analysing the production costs of
 16 actually producing the power and energy from that
 17 system, which ultimately leads to an appreciation of
 18 what would be the tariff for end-users: what you or
 19 I would pay for on our monthly utility bills.
 20 The procedures involved in this are typically
 21 extremely complex, and they seek to represent the
 22 capabilities of the system while considering the
 23 probabilistic availability of each power station and
 24 its associated capacity and yield.
 25 To grossly simplify the process -- it's what

Page 72

11:57 1 I've put on the right-hand side of the side -- we define
 2 options, we estimate the demand, we develop a plan for
 3 new plants and we estimate what is the cost of energy
 4 from that plan. And then we go through an economic
 5 evaluation process to make sure that we have an optimum
 6 plan that is affordable within the tariff expectations.
 7 The key step for my purposes today is that step on
 8 the selection of the generation expansion; that is, what
 9 is the least cost combination of plants with firm power
 10 and firm energy capacity to just meet the demand
 11 forecast. Stated another way, what is the capital
 12 investment plan for the power stations that will meet
 13 our demand forecast?
 14 Open power markets in many countries have changed
 15 some aspects of how planning is done, with a transition
 16 from direct utility investment in favour of market
 17 structuring and policy to encourage independent power
 18 producers. But the underlying requirement to have
 19 sufficient demand to meet forecast still exists. So all
 20 markets, public or private, must provide firm power and
 21 firm energy to supply the peak demands in the power
 22 system.
 23 The planning process I have just summarised is
 24 performed very early in the development process for
 25 power stations. It is generally when the underlying

Page 73

11:58 1 studies are at a pre-feasibility or feasibility level,
 2 so they are identified and there's a preliminary layout
 3 and a preliminary costing available for them. The
 4 process then proceeds after the generation plan is
 5 confirmed and additional studies are performed to define
 6 the project in preparation for its design. This can be
 7 a period of many years between when it might be
 8 identified in the planning to when it ultimately becomes
 9 available for design.
 10 So turning to slide 13. I've been referring to the
 11 terms "firm power" and "firm energy", and it's very
 12 important to recognise the differentiation between the
 13 two. But they're key inputs to the generation expansion
 14 planning process. In essence, they determine how much
 15 of the demand forecast can be reliably provided by any
 16 given power station, which then establishes when plants
 17 must be added to meet those demands. So the firm power
 18 and firm energy is the input to the generation expansion
 19 plan, or when we're going to add plants into the system.
 20 The firm power and firm energy define the
 21 capabilities of the individual power stations as it's
 22 added to the power system. So at each step, the firm
 23 power is the firm power of the total system, and the
 24 firm energy is the firm energy of the total system with
 25 that plant added.

Page 74

12:00 1 It's important to note here that the terms I use
 2 reflect a normal power planning application.
 3 Critically, the Indus Waters Treaty adopts a specific
 4 formula that simplifies this computation of the firm
 5 power by establishing the flow rate that will be used to
 6 calculate the firm power. This simplification allows
 7 for the definition of firm power without resorting to
 8 a generation planning analysis or any other assumptions.
 9 So effectively it has removed this process from being
 10 under the remit of the Treaty.
 11 So Dr Miles will address you on the meaning and
 12 application of the terms "Firm Power" and the associated
 13 term for "Pondage" as they are used in the Treaty, and
 14 you'll be able to follow up with him, I believe,
 15 tomorrow.
 16 The energy though is the accumulated amount of power
 17 over a time period. It's the same as what appears in
 18 your household utility bills as the monthly consumption
 19 in kilowatt hours. Hydropower energy is computed at the
 20 power system level as the outcome of what can be
 21 produced with the available hydrology and the power
 22 capability of the power stations.
 23 Firm energy is that amount that will have an assured
 24 availability from the power station for delivery to the
 25 customers. And typically, firm energy is found as the

Page 75

12:02 1 combination to the overall power system when a power
 2 station is added. It is computed for a critical
 3 low-flow period in the case of hydropower. It's not
 4 an average, it's actually a low-flow condition, so it
 5 has assured reliability in all cases. To be considered
 6 firm, it must be available for the planning period with
 7 the selected reliability.
 8 Firm power also must be assured available, but it's
 9 the capacity of the individual power stations and it's
 10 merely the rate at which energy is produced. It does
 11 not show the total amount of energy; it's only the rate
 12 of production of energy.
 13 People dealing with power planning and hydropower,
 14 we're quite protective of the terms "power" and "energy"
 15 as different items, in much the same way that there's
 16 a difference between cement and concrete. I would
 17 recall that in my first year of engineering, I took
 18 a course on concrete methods, and was told: if you refer
 19 to it as "cement", you fail. And the same thing comes
 20 with power and energy: they are different things and we
 21 deal with them differently.
 22 The firm power that can be produced by a hydropower
 23 station can be larger than the power generated with the
 24 flow rate available on a given day, and that's because
 25 pondage can be available so that the plant can be

Page 76

12:03 1 scheduled for less than 24 hours in a day. We take the
 2 volume of water, which is analogous to the volume of
 3 energy, and we can then reschedule that into a shorter
 4 period of time so we can use a greater degree of power.
 5 The daily peaks for that peaking operation can be
 6 a few hours during an evening period, but can be quite
 7 short. But generally in the order of four to
 8 eight hours in a typical day.
 9 It's important that if you're doing a peaking
 10 operation like this, there is a period of the day when
 11 the plant does not operate. And during that period of
 12 the day you'll accumulate the water in the pondage so
 13 that you can release it at the higher rate at a later
 14 time of day.
 15 So firm power is the amount available in megawatts
 16 that's available for dispatch by the power station at
 17 any time, and the amount of energy to be generated with
 18 that firm power determines the number of hours that the
 19 plant can operate. A traditional method of planning
 20 uses load duration analyses to show how firm power and
 21 energy from plants can be combined to stack in the
 22 overall load, and I'll show you an illustration of that
 23 in a moment.
 24 So an important thing, going forward, that is:
 25 in addition to power and energy production, power

Page 77

12:06 1 going again?
 2 So the rows going down the left-hand side show the
 3 contribution from the different available generation
 4 resources, and the one at the top is hydropower. You
 5 can see, going across the diagram, it has blue dots for
 6 almost everything, which means it is a very valuable
 7 producer of ancillary services.
 8 The ones closer to the bottom are solar, wind and
 9 battery storage. Solar and wind particularly, being the
 10 bottom two, have very few of the blue dots. So they
 11 don't have such great contributions to the ancillary
 12 services.
 13 The other ones in the middle, the thermal plants,
 14 whether oil or natural gas or steam or nuclear, all have
 15 some contribution to ancillary services.
 16 At one time, most generating facilities could
 17 contribute to these ancillary services. But as we add
 18 more solar and wind resources, utility planners must now
 19 make dedicated provisions for the ancillary services,
 20 which are defined either as direct investments or by
 21 incentivising investment by private investors through
 22 policy.
 23 The hydropower is a valuable source of the ancillary
 24 services, as indicated in the slide, but its value does
 25 depend on whether the hydro is run-of-river or storage,

Page 79

12:05 1 systems as a whole must have characteristics such as
 2 what are listed in slide 14 here, which ensure the
 3 quality of supply. And this slide is reproduced from
 4 a report by the Pennsylvania-New Jersey-Maryland grid
 5 system in the United States (P-603), and I find it's
 6 a useful diagram to illustrate typical power services
 7 common to all power systems.
 8 The columns in the chart -- and they're a bit hard
 9 to read here, but in a sense it's not essential we get
 10 every minor detail. The columns in the chart shows
 11 various services often referred to as "ancillary" or
 12 "secondary" benefits. These services include factors
 13 such as the ability to regulate voltage and the ability
 14 to regulate frequency; the ability to follow a varying
 15 load in the power system; and what is called "spinning
 16 reserve", which is the reserve available in the power
 17 system able to react quickly to changes in the load; and
 18 standby reserves, which is the ability of the plant to
 19 start up and deal with a load over a period of anywhere
 20 from minutes to hours.
 21 Other columns in the diagram are: how quickly
 22 a plant can start up; whether it has storage available
 23 for its fuel; and its ability to enable the power system
 24 to start from a black start situation: for example,
 25 after a power outage, can you bring it up and get it

Page 78

12:08 1 or even pumped storage.
 2 (Slide 15) Let's look at some of the details of how
 3 hydropower itself is operating.
 4 (Slide 16) Electricity is created by the conversion
 5 of the potential energy of water to mechanical energy at
 6 the turbine, I think as was described to you earlier.
 7 The electrical energy at the generator is provided for
 8 transmission to the power grid for distribution to the
 9 customers.
 10 Potential energy of the water is simply the
 11 difference in head between the reservoir upstream and
 12 the tailwater downstream and the density of water, and
 13 gravity. That's the potential energy. The electrical
 14 energy is a function of the efficiencies of the turbine,
 15 generator, transformer and other electrical systems.
 16 And that electrical energy comes about as we convert the
 17 potential energy of the water through the turbine to
 18 kinetic energy, and then to electrical energy in the
 19 generator.
 20 The generator itself must spin at a constant speed
 21 to create a constant electrical frequency. The
 22 frequency is determined from the rotational speed of the
 23 generator and the design of the rotor and the stator,
 24 which are the spinning and stationary part of the
 25 generator itself. And the turbine is directly coupled

Page 80

12:09 1 to the generator so it also spins at a constant speed,
 2 even with changes in flow rate.
 3 The output from the hydropower plant is the power,
 4 which varies with the flow rate and the generating head.
 5 And it's simply, again, the rate at which the energy can
 6 be delivered for a given flow rate, and it's independent
 7 of the hydrology.
 8 The other primary output is the energy, which is,
 9 again, different from power. The energy is a function
 10 of the flow rate available in the river and the power
 11 capacity of the plant. The energy is computed by
 12 aggregating the power produced in each second of the day
 13 for the whole period of time that the plant operates.
 14 As such, it's simply a sum of power over time. Energy
 15 then will be expressed in kilowatt hours or gigawatt
 16 hours, whichever; whereas power is expressed in
 17 kilowatts, megawatts or gigawatts.
 18 A very, very simplistic view here, which is
 19 important for how the plant operates -- this is in
 20 slide 17 -- that all power stations are controlled by
 21 a governor, whether hydropower or thermal power, even.
 22 The governor functions to maintain a constant frequency
 23 in the power system or to control key requirements such
 24 as flow rate and water level. The governor has
 25 different operating modes, depending on the plant

Page 81

12:12 1 units were operating at part-load, and were available to
 2 the power system to have the load adjust up or down, as
 3 needed to contribute to correction of the frequency of
 4 the power system. So they were working for ancillary
 5 benefits generation during that period of time.
 6 So we sometimes think that hydropower plants only
 7 provide a block-loading of power and energy for peaking.
 8 That's part of the role; and it's important, of course,
 9 but the availability of the ancillary services is
 10 actually also an important function of hydroelectric
 11 plants. The provision of some ancillary services will
 12 generally require that a hydropower plant is operated at
 13 a partial load, subject to governor control.
 14 What I've shown on slide 18, on the right-hand side,
 15 is a typical efficiency diagram for a Francis turbine.
 16 On the bottom is the flow rate; and the other side, the
 17 vertical axis, is efficiency. And typically, we want
 18 the plant to operate between about 60% and 100% of the
 19 rated flow. Ideally, it would operate around 80%, where
 20 it's close to the peak efficiency.
 21 So if the plant is available for ancillary services
 22 function, it's able to operate at the peak of the
 23 efficiency curve, and allow the governor to operate to
 24 vary the load a little bit up or down from that, as it's
 25 needed to provide whatever services, whether frequency

Page 83

12:10 1 characteristics and the power system.
 2 This is one of the large sets of equipment that you
 3 will have seen on the turbine floor level during the
 4 Neelum-Jhelum visit. It will have been large tanks of
 5 oil and other gear that were pretty hard to understand
 6 what they were. But this is part of the governor
 7 system.
 8 In very simplified terms, there's a sensor which
 9 continuously monitors the rotating speed of the turbine
 10 and the position of its wicket gates. If the speed
 11 falls below a set point, then the governor injects oil
 12 in the system, which causes the wicket gates to open and
 13 the speed of the turbine to increase to match the set
 14 point. And similarly, it goes the other direction and
 15 reduces the flow if it's going down.
 16 But the governor also has set points available to be
 17 able to control water level, flow rate or even power
 18 output. The governor systems available today then
 19 monitor the speed, and react to the power system to
 20 adjust the power plant to maintain the set point
 21 positions.
 22 So during our visit to the Neelum-Jhelum control
 23 room, if you recall, the operator said that the
 24 generator was operating for frequency control on that
 25 day. What he means by that is that turbine generator

Page 82

12:14 1 control or spinning reserve, or to follow the load
 2 changes in the power system.
 3 But the contribution of run-of-river hydropower will
 4 vary seasonally. And a plant on full load during the
 5 wet season produces more energy, but it contributes less
 6 to what I call the ancillary services.
 7 At part-load, the plant has some spinning reserve.
 8 And spinning reserve again is: every time you go in
 9 a room and you flip on a light switch, you increase the
 10 power demand in the power system, and some power station
 11 somewhere in the system must react in order to pick up
 12 all those thousands of people flipping on light
 13 switches. And that's what spinning reserve does: it
 14 allows the plant to operate automatically to make that
 15 adjustment.
 16 The governor will vary the turbine flow to follow
 17 the frequency, to control water levels or to control the
 18 flow rate, whatever is set as the requirement. The
 19 operating turbine can ramp the load up or down rapidly,
 20 if it's already operating. This is frequently required
 21 for systems that include solar generation. I'll
 22 demonstrate to you in a moment here how variable solar
 23 can be, and why it's important to have systems like
 24 hydro that can provide some of this contribution.
 25 So why do I say all this? Well, pondage is

Page 84

12:15 1 necessary in hydropower projects to provide the energy
 2 storage needed to allow for these variations in the
 3 turbine discharge when it does not match precisely with
 4 the inflow. So you may have all of these things
 5 happening in the power system, and that creates minor
 6 change or small changes in the power plant, and we then
 7 need the pondage to buffer those. It provides a volume
 8 available for surplus or deficit storage within the
 9 system.
 10 So in this sense, the pondage is reacting to the
 11 loads of the system by adjusting the loads of the plant.
 12 I differentiate loads of the system from loads of the
 13 plant: they're again different, because any one plant
 14 doesn't deal with the entire system; they're no longer
 15 isolated, they're all integrated. So pondage is our
 16 buffer to provide that ability to deliver these
 17 ancillary services to a power system. Pondage is also
 18 used for the daily peaking if the plant is scheduled for
 19 only certain hours in the day.
 20 So if we come down to the level of the power system,
 21 what I've put on the slide here in slide 19 is a typical
 22 daily load curve for the "all India" case in India.
 23 These are produced by an agency in India which makes
 24 some information available. But it shows, minute by
 25 minute, the power that must be delivered into the

Page 85

12:19 1 an illustration of the effect of the curves day by day
 2 or season by season. And what we see here is that there
 3 is not a single load curve that is characteristic for
 4 the power system, where each day is reproduced
 5 identically. They are different: every day, every
 6 month, and from year to year. This is four that were
 7 presented for 2014 and 2015 in the available reference.
 8 It shows again that there's a very significant
 9 baseload, but it also shows some significant difference
 10 between years, which I don't fully understand, to be
 11 honest, but this is what was provided in the reference
 12 document. The difference is very significant between
 13 the seasons, and this is four typical seasons of the
 14 year.
 15 So all plants in the power system will operate to
 16 some degree to supply this hourly demand variation, and
 17 this is especially true of storage hydropower projects
 18 that have flexibility to schedule the timing of their
 19 generation. Gas turbine and diesel plants adjust load
 20 very quickly and they will tend to fill the upper part
 21 of the peaks in these diagrams. And even coal-fired
 22 plants will fill part of it, and that would be typically
 23 from the nighttime through part of the daytime.
 24 Run-of-river hydropower projects can vary their load
 25 subject to the pondage available and the flow available

Page 87

12:17 1 system. And if you take the area under the curve, that
 2 would be the energy; whereas the left axis is the power;
 3 and of course the bottom is the time. So if you take
 4 the area, you're taking the power in megawatts times the
 5 time, giving you megawatt hours, which is the area under
 6 the curve or the energy.
 7 And note also that this is only the upper part of
 8 the curve. The left axis would actually show that about
 9 100 GW below the bottom of this curve is baseload: it's
 10 there all the time. And it's only the variability on
 11 the top, which is about from 80% to 120% of the average.
 12 So in practice, the system operator, or the dispatch
 13 operator, has to select a pattern of power stations to
 14 enter the system on a daily basis to respond to this
 15 sort of load variation. The operator must always
 16 schedule plants that are going to deliver whatever
 17 required ancillary benefits. Whether the spinning
 18 reserve or standby reserve or frequency control or
 19 whatnot, they also have to be scheduled. So they
 20 actually have a big job, if we're looking at a system of
 21 about 100 GW and we're scheduling plants of 100 MW,
 22 those plants start to look pretty small. So you have to
 23 imagine the operator, doing this every day, has to have
 24 some shortcuts.
 25 (Slide 20) But before we get there, this comes to

Page 86

12:20 1 in the river. Peaking using pondage, though, is only
 2 available during the part of the year when the flow rate
 3 is less than required to generate at the installed
 4 capacity.
 5 If you are into the wet season of the year and these
 6 plants are full-loaded, they are supplying the load at
 7 the bottom of these diagrams, where it's continuous
 8 through the day. In the dry season, there is some
 9 variation through the day, and it's a matter of making
 10 that continuous enough to fill those long periods of the
 11 higher loads, which are typically in the order of six to
 12 eight hours.
 13 But it's important to recognise that pondage is not
 14 the only factor that determines the peak-period energy
 15 provided from a run-of-river plant. The energy
 16 available is ultimately limited by the stream flow on
 17 any day.
 18 (Slide 21) So what we do with these is actually,
 19 from a generation planning perspective, we want to
 20 simplify this, because those are very difficult to deal
 21 with if you're doing generation planning analysis. So
 22 we've simplified them here by reorganising them into
 23 load duration curves. And all this is showing is
 24 a percentage of time on one axis and power on the other
 25 axis. And again, if you were to integrate the area

Page 88

12:22 1 underneath these curves, you would come up with energy.
 2 So again, the two remain different.
 3 All our generation planning process does is try to
 4 determine how we could what we call "stack" the projects
 5 in there, so that each one has a slice horizontally
 6 where the area of the slice is equal to the energy
 7 available and the depth of the slice is equal to the
 8 power available. So if we have a firm power available
 9 for a plant, we then take the amount of energy we have,
 10 and we find a place in that diagram where the two fit
 11 and match it optimally.
 12 When we actually do it for generation planning,
 13 it gets a whole lot more complicated, but I don't think
 14 we need to get into the details for that.
 15 (Slide 22) So that brings me to operation with other
 16 renewable sources.
 17 What is often referred to as "other renewables" is
 18 now the fastest growing source of power generation in
 19 almost every part of the world. "Other renewable
 20 energy" generally refers to solar and wind as the main
 21 contributors, but the classification can also include
 22 biomass, geothermal, ocean energy and a host of other
 23 systems that are available. The largest, though, of
 24 these is solar and wind. The addition of the other
 25 renewable energy to an integrated system affects how the

Page 89

12:25 1 complementary facilities in the power system, both from
 2 various electrical devices at the distribution level but
 3 also at the generation level. A key issue is the
 4 variability of the generation and the need for energy
 5 storage, which must be provided after the transformation
 6 to electricity.
 7 With our traditional generation resources, energy
 8 storage was easily available. It was done before we
 9 generated electricity: we had heaps of coal at power
 10 stations, or we had liquid fuels, or we had nuclear fuel
 11 bundles, or we had natural gas reserves. All of these
 12 were energy stored before transformation.
 13 Hydropower plants -- storage hydropower,
 14 reservoirs -- can provide seasonal energy storage, but
 15 run-of-river doesn't offer much in the way of energy
 16 storage because the energy is available on a day-by-day
 17 basis. It has some very short-term storage that we can
 18 talk about.
 19 Pumped storage -- and I've referred to this a little
 20 bit today -- or batteries can be used to provide
 21 dedicated energy storage not limited by hydrology, and
 22 can be configured to maximise financial returns
 23 available from the marketing of energy.
 24 (Slide 24) So just to give a bit of a background on
 25 these sources. What I show in this diagram -- and this

Page 91

12:23 1 other generation works, especially hydropower.
 2 So when we look at the area here, as illustrated in
 3 slide 23, India, and even more so Pakistan, is well
 4 situated for solar generation. I am speaking
 5 predominantly about solar in the coming remarks,
 6 although it's to some degree also related to wind. Both
 7 countries are well situated for generation of solar,
 8 which can be obtained from utility-scale plants, plants
 9 in the order of hundreds of megawatts, as well as from
 10 farm- or household-scale plants.
 11 Solar and wind energy can be expected to exceed
 12 hydropower generation in coming years, as new solar and
 13 wind generation will outpace the possible additions to
 14 the hydropower sector. As an example, there's recent
 15 press reports in India of a solar park to produce 30 GW
 16 of power that's planned for the state of Gujarat.
 17 That's 30,000 MW in one solar park.
 18 An important advantage of these resources is that
 19 solar especially can be located closer to the demand,
 20 allowing for some reduction in transmission losses.
 21 However, the other renewable resources do require
 22 improvements in the transmission grid generally, but the
 23 connectivity, at the same time, improves the reliability
 24 and consistency of solar and wind.
 25 Both projects have characteristics that require

Page 90

12:26 1 is taken from the organisation IRENA, which shows the
 2 evolution in costs for renewable energy sources.
 3 I don't know if it's very clear, but in each column, or
 4 in each section, you have bioenergy, geothermal,
 5 hydropower, solar photovoltaic, which is most of what we
 6 get from solar, onshore and offshore wind, and what's
 7 called concentrating solar power.
 8 It's interesting to look at each of these. I'll
 9 focus mainly on the solar and wind. It shows levelised
 10 cost of energy, which is a way of computing a value of
 11 energy which determines its capacity cost and all
 12 lifecycle costs involved in the generation of energy
 13 from that source, and it allows us to compare projects
 14 on a common basis.
 15 The values here are world weighted averages. So
 16 there can be locally different conditions, but the
 17 trends over the time periods are clear.
 18 We can see in the yellow in the middle of the
 19 figure -- I hope it's coming through as yellow for
 20 you -- that the cost of solar has declined dramatically
 21 over the ten-year period that was given here, and now
 22 we're producing solar at about 4.9 cents per kilowatt
 23 hour. One over, at the onshore wind, it's producing
 24 energy at a cost of about 3.3 cents per kilowatt hour.
 25 Hydropower is the other key source in there. It has

Page 92

12:28 1 a typical value of around 6, or just over 6 cents per
 2 kilowatt hour. But note that the cost of the solar and
 3 wind especially are declining with time, whereas
 4 hydropower continues to increase, because it's more
 5 affected by the general economic development, and it's
 6 a mature technology, so it doesn't have technological
 7 improvements that would tend to bring down costs.
 8 The hydropower costs will vary depending on whether
 9 the plant is configured with a storage reservoir or as
 10 run-of-river. But generally, a storage reservoir
 11 hydropower would allow for much greater capture of the
 12 available energy, while increasing the benefits to the
 13 power system for firm energy and firm power. So we
 14 might see a greater value in one of those projects.
 15 (Slide 25) For comparison -- if you just remember
 16 those numbers: 3.3, 4.9 and 6 -- if we look at thermal
 17 power plants, which is from the same reference and is
 18 showing the cost of thermal power plants from
 19 combined-cycle gas turbines, which is actually the most
 20 common thermal plant in the United States right now,
 21 coal, which is the steam plant using coal as a fuel,
 22 which is declining in many areas but still prevalent
 23 here, open-cycle gas turbine and oil-fired plant. The
 24 best cost of these is about 5.8 cents.
 25 The big uprise to the right of these diagrams just

Page 93

12:31 1 But a key thing is the variability within the day
 2 for solar, and the biggest limitation is that it doesn't
 3 have anything, of course, in the nighttime hours. So we
 4 need other generation sources to complement the solar,
 5 and a key requirement is fast-reacting power.
 6 But one of the limitations we have is that even with
 7 those spikes up and down that you see on that figure,
 8 they're faster than what a typical hydro turbine can
 9 react to. The hydro turbine will have a certain amount
 10 of inertia, but its ability to change its load to follow
 11 these spikes, that ability is not there. It can change
 12 in minutes, not seconds. So there is a need for
 13 short-term storage using batteries to buffer some of
 14 this.
 15 So to the extent that there is extended periods
 16 during the day when the power shuts off, that's when the
 17 spinning reserve and the hydropower can react and fill
 18 in those periods. But the nighttime storage is needed
 19 for the transfer of surplus from the daytime to the
 20 nighttime.
 21 When it comes to run-of-river hydropower, it's
 22 important to realise that run-of-river hydro does not
 23 actually store energy. What we're able to do in
 24 a run-of-river is only defer the energy available in
 25 one part of the day to the latter part of the day, or

Page 95

12:30 1 shows the sensitivity to the price of fuels. We've had,
 2 of course, some important upheavals in the latter years,
 3 because of Covid and geopolitical interruptions around
 4 the world.
 5 But the floor value for the LCOE for thermal plants
 6 is about 5.8 cents, based on this information. Note
 7 these are just the costs for the supply of energy. The
 8 end-user cost is higher, once the additional system
 9 costs for transmission, distribution, energy storage
 10 and, importantly, ancillary services are included in the
 11 analysis.
 12 So, having said now that we can produce solar at
 13 a lower cost than thermal, or likely even lower than
 14 hydro, why isn't it the only new generation being
 15 provided? Slide 26 illustrates part of the problem.
 16 On a good day, on the left-hand side, the generation
 17 tracks the solar radiation through the daylight hours,
 18 even though there are still some minor fluctuations.
 19 However, on a poor day, the solar production varies
 20 significantly, with frequent large swings in output.
 21 This is the bits jumping up and down very rapidly.
 22 These figures come from a small solar installation on
 23 the roof of my house in southern Canada, so I can pick
 24 any day you'd like and I can come up with similar
 25 diagrams.

Page 94

12:33 1 into the peaking period or nighttime period. It's
 2 an energy deferral, it's not an energy storage. For me,
 3 an energy storage is if I take part of that surplus
 4 available in the daytime and I can store it and draw
 5 from it later. Run-of-river doesn't do that.
 6 The energy storage available or the energy deferral
 7 available for run-of-river can be unreliable because it
 8 depends on the watershed hydrology, so what is the flow
 9 rate of that day. And that tells me how much energy
 10 I can actually get in the peak period, if I'm able to do
 11 some moderate peaking.
 12 So the system still requires something to do that.
 13 And that's where we come into the development of storage
 14 hydropower, which is specifically developed to provide
 15 dedicated storage for these systems; or the use of
 16 battery storage, which both deals with the short-term
 17 buffering of the very abrupt changes, but also for
 18 utility-scale uses for the daily energy storage.
 19 (Slide 27) If I go off my rooftop, this is what you
 20 get in the state of California. I picked a typical day:
 21 this is June 5, 2024, just for information's sake. It
 22 shows how the other renewable energy sources are
 23 integrated in a large power system.
 24 The gold colour is solar. That's what's produced on
 25 a typical day in California where we are today. And the

Page 96

12:34 1 problem for the system operator is: how do I react to
 2 that? How do I fit that in and fill the evening?
 3 Another thing to notice in here is the hydro line,
 4 which is the pale blue near the bottom. That draws from
 5 a whole series of hydropower energy resources within the
 6 state of California, but it has a very moderate peak
 7 between the day and the evening. This is largely due to
 8 a variety of hydrological, technical or environmental
 9 constraints that constrain how these projects can be
 10 used abruptly.
 11 Most of the contribution to the evening peak, over
 12 there, is provided by the fact that on this particular
 13 day, it wasn't very windy during the day, but then the
 14 wind picked up in the evening, so there was some
 15 generation from there.
 16 But the largest part, a discretionary availability
 17 to the power utility, is natural gas sources, which is
 18 the darker blue across the bottom, and the use of
 19 batteries, which is in the pale green colour.
 20 California is a state that has recently developed
 21 over 10,000 MW of battery capacity dealing with this
 22 evening storage problem. Note that -- it's hard to see
 23 in the figure, but the battery actually gets used almost
 24 through the entire day, because it's also dealing with
 25 that short-term variability of the solar as it comes on

Page 97

12:38 1 So the hydropower in that case provides the
 2 ancillary benefits to support the solar, especially with
 3 respect to the inertia, the spinning reserve and the
 4 load following. The inertia has to do with making sure
 5 that you don't have very abrupt changes in the system.
 6 You want enough of what's called "inertia" so that small
 7 interruptions don't create a large disruption at the
 8 customer level.
 9 However, these sorts of benefits -- spinning
 10 reserve, load falling, inertia -- they're only available
 11 if the hydropower station is actually running during the
 12 period when solar energy is being produced. The energy
 13 transfer for peaking is also possible, but the
 14 run-of-river hydropower is of course limited in this
 15 because of the amount of energy available for deferral.
 16 Another difficulty is that the ability of
 17 run-of-river hydro to transfer energy during the wet
 18 season is effectively zero. So it doesn't have solar
 19 energy storage in wet season because the water is
 20 available to run as baseload. What that means is that
 21 the poor utility planner has to provide enough
 22 capability in the system so that they can provide that
 23 energy storage and energy transfer during the whole
 24 year.
 25 If you've provided it for the wet season, because

Page 99

12:36 1 and off: clouds pass by and whatnot.
 2 A similar picture to this occurs in any area of the
 3 world with large solar power inputs to the system. The
 4 system must have energy storage available to shift some
 5 of that daytime surplus into evening hours and it must
 6 also be able to contend with, in the case of
 7 run-of-river, the available hydrology.
 8 So one of the keys for system planning is to
 9 increase the connectivity within the grid system. That
 10 filters some of the local variability with the solar and
 11 wind. But it's also improving regional interconnection
 12 so that the energy can be shared in a larger pool and we
 13 see that in this diagram as the imports, which are
 14 regional power exchanges between the power pools in the
 15 United States. In the case of India, they have regional
 16 exchanges between their power pools.
 17 In the industry, there's a lot of talk about
 18 solar-hydro hybridisation. On slide 28, I put some
 19 items around this.
 20 In particular, given that solar can produce energy
 21 at a very good price, what can we do with a hydropower
 22 system so we can turn that variable solar energy into
 23 a dispatchable energy that's well suited for the power
 24 system? That's what we mean by hydro-solar
 25 hybridisation.

Page 98

12:39 1 your poor run-of-river hydropower project cannot provide
 2 it then, so you've provided it anyways. To the extent
 3 that you get some capability in the dry season, well,
 4 I've already got that capability in these other
 5 facilities, so I can't count that as a benefit of that
 6 run-of-river hydro: it's just an energy producer.
 7 So solar generation is important, but it doesn't
 8 really fundamentally change how we're going to use our
 9 run-of-river hydro plants. They will be used in the
 10 power system because of their ability to generate
 11 baseload energy. They have some capability for peaking
 12 in the dry season, at least to some degree, with the
 13 energy available. But they don't completely replace
 14 other dedicated energy storages that are going to be
 15 needed for the other renewable energies.
 16 The ancillary services that are provided with the
 17 energy peaking are limited to that available from the
 18 hydrology. So in some ways, the more important
 19 operation of a hydro coming even in the dry season may
 20 be to be available for provision of the ancillary
 21 services, more so than the peaking, because we've
 22 provided dedicated energy storage for the solar and the
 23 wind somewhere else. So the best thing you maybe get
 24 from this is the amount of the ancillary services, which
 25 comes down to frequency, inertia, spinning reserve and

Page 100

12:41 1 the like and that's a very valuable resource within the
 2 system, and it doesn't diminish the value of the
 3 project; it just changes how it's considered in the
 4 system.
 5 (Slide 29) So a very brief word, because how the
 6 plant is used in the system depends on its pondage.
 7 When I talk about, "Perhaps, with more solar, we're
 8 going to have a greater use of ancillary services for
 9 the plants", well, that comes into the need to have some
 10 pondage available. Because you need that pondage to be
 11 able to have minor fluctuations from the power system,
 12 which affects the plant, which then doesn't necessarily
 13 match directly with the flow available, so we get the
 14 pondage as the buffer.
 15 So when we compute pondage, typically we're simply
 16 taking the energy available on the day, we're seeing if
 17 we can shift it to part of the day, and we can then
 18 calculate the volume. It's a fairly straightforward
 19 computation: it just determines the number of hours of
 20 dispatch and the volume we store.
 21 When we deal with pondage for hydropower energy
 22 transfer with the solar, we can calculate it the same
 23 way, but then we would recall that we're not necessarily
 24 going to use it the same way. So we look for this
 25 ongoing transition. It's my own opinion, to be honest,

Page 101

12:43 1 then leave it to your own discretion if you want to know
 2 more. These are mainly observations, as opposed to
 3 conclusions.
 4 (Slide 31) But I would say that recent cost trends
 5 show that there will be increasing development of
 6 variable renewable energy sources in the coming years.
 7 This is something that we can anticipate everywhere
 8 around the world.
 9 We can also anticipate that hydropower will be
 10 developed selectively to capture the ancillary services
 11 benefits, and plants with limited flexibility will find
 12 it more difficult to compete with lower cost energy
 13 producers. And by "limited flexibility", I mean if
 14 you're heavily constrained by environmental constraints
 15 or physical constraints, it may affect how they work
 16 when they're compared against alternatives.
 17 I would also anticipate that fewer thermal power
 18 producers will be available in most power systems as we
 19 go forward. You see this in North America, certainly;
 20 the province of Alberta just this week announced that
 21 they've finally shut their last coal-fired plant. So
 22 years ago I worked on design of coal-fired plants in
 23 Alberta, and now they're all gone. And they've replaced
 24 with a system of solar, wind and natural gas.
 25 Wind and solar in particular require dedicated

Page 103

12:42 1 but I expect these run-of-river hydro plants to be used
 2 much more for the ancillary services role, or the
 3 buffering role, than they will be for the energy
 4 transfer role, which we're going to get from other
 5 services.
 6 So whether it's used seasonally -- provision of some
 7 daily energy or storage, for some energy storage for
 8 peaking, or for the ancillary benefits -- the
 9 run-of-river hydros still have a benefit and they still
 10 have a value in the system; it's just that the value or
 11 the usage may change somewhat.
 12 Now, the Indus Waters Treaty has special definitions
 13 for "Pondage", and I don't want to go further into the
 14 calculation of it here; this will be discussed by
 15 Dr Miles in the coming days.
 16 But the role of the hydropower projects with wind
 17 and solar is going to be similar to what it's doing now:
 18 it's going to provide limited daily peaking seasonally,
 19 some ancillary services benefits, and the baseload
 20 operation in the wet season. Clearly it does not
 21 replace the need for dedicated energy storage for the
 22 other renewables.
 23 (Slide 30) So I've covered a lot of different
 24 aspects and, to be honest, very superficially but
 25 I would like to summarise with a few observations and

Page 102

12:45 1 energy storage, and to date this has involved large
 2 battery installations in many utilities and they're
 3 important because they're available year-round. So they
 4 don't have the seasonal differentiation that we get with
 5 some hydro.
 6 Pumped storage is available or is planned in many
 7 countries, India included. They have a very ambitious
 8 programme of pumped storage here. It provides a useful
 9 combination of dedicated storage, the ability to consume
 10 surpluses, and the provision of ancillary services. And
 11 with pumped storage, you can provide ancillary services
 12 both on the pumping and the generation phase, so you get
 13 it on both parts, depending on the equipment you put in.
 14 I've illustrated that power system load curves are
 15 variable and there is no single characteristic daily
 16 pattern of loading. As such, these curves are not used
 17 for the design of any individual power station, but
 18 they're rather used for the overall power system. You
 19 only deal with the curves as you add plants in
 20 combination with other plants to fulfil the whole load
 21 duration curve.
 22 Pondage: you'll be hearing a lot more about pondage
 23 coming up, but it's a function of the energy available
 24 from the hydrology and the firm power available for the
 25 site and the three -- power, pondage and energy -- are

Page 104

12:47 1 related, as will be discussed in more detail coming up.
 2 It is an important factor in the optimal use of
 3 a run-of-river hydropower project, but it doesn't
 4 replace other dedicated energy storages required in the
 5 power system.
 6 That would conclude my prepared remarks.
 7 THE CHAIRMAN: Thank you, Mr Rae, very much.
 8 Let me just check with my colleagues and see if we
 9 have any questions.
 10 Professor Buytaert.
 11 (12.47 pm)
 12 Questions from THE COURT
 13 PROFESSOR BUYTAERT: Thank you very much, Mr Rae. This is
 14 a question that doesn't directly relate to what you
 15 presented here. But as you know, we've had the honour
 16 of visiting the Neelum-Jhelum plant, where we got a lot
 17 of details about its design and its operation.
 18 But do you have any insights on how, for that
 19 particular plant, the pondage calculations were done,
 20 what factors were included to get to the number that was
 21 eventually built?
 22 MR RAE: I don't have any insight on that myself. I wasn't
 23 directly involved with that plant, or involved at all
 24 with the plant. So I would have to defer that question
 25 to our colleagues in Pakistan.

Page 105

12:50 1 I can say it's a difficult problem to do, because
 2 you're dealing with parameters or data which changes
 3 very quickly, and at the same time you're trying to
 4 match variable power with variable production, and the
 5 limitations of the hydro equipment. For example,
 6 a hydro turbine governor, we talk about them being able
 7 to react, but they can't react in milliseconds, which is
 8 what we're getting on the solar. So we have the other
 9 buffers involved.
 10 Pondage does come out of that calculation. In that
 11 case it's further complicated because we're trying to
 12 match pondage with an eco-flow study, so that the
 13 outcomes of the eco-flow are matched into the
 14 optimisation of the hydro.
 15 So it's a long way of saying I don't have an answer.
 16 I can say that it's evolving very quickly. But at the
 17 initial point, people have just been making what looks
 18 like reasonable provision for pondage and then seeing
 19 how it works if they start modelling the systems in more
 20 detail.
 21 PROFESSOR BUYTAERT: Thank you.
 22 THE CHAIRMAN: Mr Minear.
 23 MR MINEAR: Thank you, Mr Rae. It was very helpful.
 24 I have two questions. One just goes to my
 25 understanding of your presentation and talking about

Page 107

12:48 1 I thought that question was asked during the visit,
 2 was it not?
 3 SIR DANIEL: And I think it was one of the written
 4 questions, which we'll come back to.
 5 PROFESSOR BUYTAERT: Okay, thank you.
 6 MR RAE: Sorry.
 7 PROFESSOR BUYTAERT: That's fine.
 8 And then a second, broader question. So you very
 9 clearly sketched the evolution towards more renewables.
 10 How would the design of a plant and pondage in
 11 particular -- or how does that inform the calculation of
 12 pondage? Is there any established methodology to deal
 13 with the inevitable uncertainty of future changes in
 14 demand and variability?
 15 MR RAE: I would say this is an area which is changing
 16 extremely rapidly within the industry, and there is
 17 a lot -- so I can't say that there's any one accepted
 18 methodology yet. I would say that it's changing so
 19 dynamically that almost month by month, people are
 20 coming up with different ideas of how to do this.
 21 I'm involved with another project in Liberia, on
 22 a panel where we're trying to integrate the hydro and
 23 the solar in a hybrid way, where we mix in a mix of
 24 batteries along with the plants in order to work in
 25 an isolated way from any other thermal power resources.

Page 106

12:51 1 turbine governors.
 2 You said that the object here was to maintain
 3 constant speed despite variation in the flow rate. Does
 4 that mean you're effectively moderating the water
 5 pressure in the turbine?
 6 MR RAE: What it does is: when the governor operates, if
 7 it senses a change in speed, it injects hydraulic oil
 8 into the system, which then gets amplified through pumps
 9 and the like, and it moves the wicket gates. So if
 10 there's a change in speed, it actually turns the wicket
 11 gates, which affects the amount of flow going through
 12 the turbine.
 13 So anything to do with frequency or any other change
 14 occurring at the generator level produces an adjustment
 15 in the flow rate through the unit; and by changing the
 16 flow rate, you're adjusting to correct the speed.
 17 MR MINEAR: I see. Thank you.
 18 My other question goes to load curves, and the
 19 variability of load curves. You mentioned that there's
 20 seasonal variability; I imagine there's also variability
 21 depending on the developed character of a nation. For
 22 instance, I would think that the load curve for
 23 a developed country would be quite different from
 24 a developing country. Am I right in that?
 25 MR RAE: You are correct in that. And at one time we used

Page 108

12:52 1 to use these things for generation planning and these
 2 load-stacking arrangements, and what you find is that
 3 the slope of the curve, as you increase your level of
 4 development, this slope becomes flatter.
 5 If you have a very -- one of the problems with the
 6 smaller, isolated grid systems is the curves are always
 7 very steep, because you were dealing with a small group.
 8 The plant shut down that night, so the load went to zero
 9 and the load disappeared.
 10 So, yes, the shape depends on the level of
 11 development in the grid.
 12 MR MINEAR: Just to explain why I'm asking these questions,
 13 I expect we'll talk about load curves with regard to
 14 India's approach to pondage, and I just want to make
 15 sure I have a good understanding of some of the
 16 variabilities in load curves.
 17 My other question with regard to load curves: is
 18 there a change over time with regard to changes in the
 19 supply and demand of energy? For instance, in the
 20 United States we're using more electrical cars now, and
 21 so they are charged at night. I assume that would
 22 change the load curve; is that right?
 23 MR RAE: Yes, electric cars are a very interesting thing,
 24 because the other thing that's happening and starting to
 25 emerge in the US is demand management. And demand

Page 109

12:55 1 in trying to minimise the use of energy in peaks is to
 2 do exactly that sort of thing.
 3 I do it at home. My hot-water heater doesn't come
 4 on at certain hours of the day because it costs me more
 5 money. But I use it in the morning, and by the time
 6 I come back to it the next morning, it's hot.
 7 There's storage of energy in your hot-water heater
 8 in the form of heat. If we get more people's behaviour
 9 to change, that we're storing at different times, then
 10 we adjust the shape of the load curves with time.
 11 MR MINEAR: One last question, again going to what
 12 I anticipate will be some questions for Dr Miles.
 13 Is the shelf life of demand curves shortening over
 14 time? I assume that these load curves are often based
 15 on a 15- or 20- or 30-year time horizon.
 16 MR RAE: (Slide 21) Well, you see on this figure they're
 17 done annually. But you can see on the figure there's
 18 a kind of an evolution from 2008 to 2015, or 2015/16.
 19 And unfortunately the curves go the opposite to what
 20 I said a minute ago. They should be becoming flatter;
 21 they're actually becoming steeper in this case. But
 22 that, I think, has got to do with how the system is
 23 evolving and the particular details here.
 24 But we do them every year. And when you go into
 25 a generation planning process, you tend to pick a load

Page 111

12:54 1 management allows you to take advantage of all those
 2 electric cars as one of your ways of doing energy
 3 storage. And if you can incentivise people to make
 4 their batteries available at a certain time of day for
 5 either storage or support, then you can start to
 6 mitigate the amount of other storage you need in the
 7 system.
 8 So there's a whole part of power utility development
 9 which is around the demand management part of it which
 10 goes in there.
 11 But with respect to the load curve, you're also
 12 correct, in that the time-of-use structure affects these
 13 curves. In most utilities, whether in Europe or
 14 North America, we have pricing structures which tend to
 15 favour certain times of day. The whole idea is to bring
 16 down the peak and bring up the base so that you get
 17 a more uniform load through the day. We do that through
 18 policy and through pricing. Ultimately it's going to be
 19 through more demand management, and active management.
 20 The problem with demand management is: many people
 21 in the United States don't want to give up the freedom
 22 to say, "I can operate any way I like".
 23 But in the ultimate demand management, the utility
 24 is able to control when you turn your hot-water heater
 25 on or off, and that sort of thing. Part of what we do

Page 110

12:57 1 duration curve like this and use that as a basis.
 2 Because there's so many other imprecisions in the
 3 analysis that somehow the finer details don't really
 4 have that much effect.
 5 MR MINEAR: Thank you, Mr Rae.
 6 THE CHAIRMAN: Mr Rae, when Sir Daniel was introducing the
 7 speakers today, he noted that you were involved in the
 8 Baglihar proceeding. And in your presentation today,
 9 you talked a bit about: pondage needs to be computed to
 10 address the fluctuations in the water to deliver energy
 11 into the system.
 12 I think I noted on Monday that Pakistan's method for
 13 calculating maximum pondage, as was argued in the
 14 Baglihar proceeding, seems to be different from the
 15 method that is being advocated for in this proceeding.
 16 Specifically, when I looked at Exhibit 9 to Pakistan's
 17 Memorial in the Baglihar proceeding, it seemed to see
 18 relevance in a seven-day mean minimum discharge, and in
 19 developing pondage based on lower inflows than the mean
 20 over the course of a week.
 21 So my basic question is: why did Pakistan change its
 22 mind about how pondage should be calculated?
 23 MR RAE: I think some of those details will be dealt with by
 24 Dr Miles. But I would reflect that some of what you see
 25 in those documents was driven a bit by what the Neutral

Page 112

12:58 1 Expert was asking us for, so that in some sense we were
 2 trying to respond in some cases to questions; in other
 3 cases it appeared in the memorial or rejoinder.
 4 But I would like to defer that question so that
 5 I can look more closely at what we said in Baglihar on
 6 this particular issue, and also to Dr Miles's
 7 presentation. I think he is planning to go through the
 8 history of these.
 9 THE CHAIRMAN: Well, I welcome your reflecting on it, and
 10 I certainly welcome Dr Miles's presentation on Friday.
 11 I do hope that Dr Miles doesn't tell us that he wasn't
 12 involved in the Baglihar proceeding and therefore can't
 13 answer the question, because obviously we are interested
 14 in the answer.
 15 MR RAE: If it's unclear, I am certainly happy to come back
 16 and help at some point, when I've reviewed the file on
 17 the particular issue.
 18 THE CHAIRMAN: That's fine. Thank you very much.
 19 So I think we have no further questions. But I do
 20 want to thank you very much, Mr Rae, for your
 21 presentation. It was very helpful to us. You have
 22 taken us exactly to the lunch hour, so well done in that
 23 regard as well.
 24 Sir Daniel, I note that we are a little bit behind
 25 where we thought, but we also had a fair amount of time

Page 113

13:01 1 come back at our normal time of 2 o'clock.
 2 SIR DANIEL: An alternative may be just to have a sort of
 3 slightly shortened coffee break if we feel we need it.
 4 It may be that Stephen Fietta and Philippa Webb go
 5 rather shorter than our one-and-a-half-hour planning.
 6 THE CHAIRMAN: Alright. Well, let's come back at 2.15 and
 7 see where we are as we move along in the afternoon, and
 8 we may have a shorter coffee break then.
 9 SIR DANIEL: Thank you very much.
 10 THE CHAIRMAN: Very good. See you at 2.15.
 11 (1.02 pm)
 12 (Adjourned until 2.15 pm)
 13 (2.21 pm)
 14 THE CHAIRMAN: Okay. With apologies for a few minutes of
 15 delay in reassembling, it's good to see everyone again.
 16 I believe it's Mr Fietta who is up next in the
 17 order. So, Mr Fietta, whenever you're ready, please
 18 proceed.
 19 MR FIETTA: Thank you, Mr Chairman, members of the Court.
 20 I hope you had a good lunch and we're now, I think,
 21 ready to go with the next presentation.
 22 Could we load it up? Thank you.
 23 Submissions on Baglihar and Kishenganga Systemic
 24 Interpretation Issues and Response to Question (a)
 25 MR FIETTA: (Slide 1) So, Mr President, members of the

Page 115

13:00 1 built in as a contingency this afternoon, so it seems
 2 that we're not under any particular time pressure. And
 3 I'm wondering in that regard if we might reconvene at
 4 2.15 rather than 2.00, to give us a little bit more time
 5 for a lunch break, unless you think that poses any
 6 difficulties.
 7 SIR DANIEL: No, Mr Chairman, I think that would be fine
 8 from our perspective.
 9 Just to give you a sense of how we were hoping to
 10 plan the rest of the day, immediately after the lunch
 11 break, Stephen Fietta will be coming on. And we expect
 12 that his submissions, barring too many questions, would
 13 take us up to the coffee break. And then Professor Webb
 14 just after the coffee break. And once again, her
 15 submissions, including some questions -- not a huge
 16 volume of questions -- should take us through to the end
 17 of day.
 18 I wonder whether we might have a little bit of
 19 a latitude of 10-15 minutes at the end of the day to
 20 complete Professor Webb's submissions, so that we've got
 21 then a clear run on some of the paragraph 8 stuff
 22 tomorrow, or whether you want to have your 5.30 as
 23 a sharp guillotine for the end of the day.
 24 THE CHAIRMAN: I think we want to keep 5.30 relatively
 25 sharp. So in light of what you've just said, I think we

Page 114

14:21 1 Court, my task today is to address you on the systemic
 2 interpretation issues under the Treaty and respond to
 3 your question (a) in Procedural Order No. 6, dated
 4 6 July 2023.
 5 You should have your latest party pack from me in
 6 your folders: I think it should be at tabs 7 and 8. You
 7 won't need to go to it for now, until I prompt you.
 8 I will take you to tab 8 when we get there, where
 9 we have another A3 presentation, but that will be some
 10 time into my address.
 11 (Slide 2) Before I elaborate on Pakistan's
 12 substantive responses to question (a), I would like to
 13 make a number of high-level remarks by way of
 14 introduction and context to the Court's question.
 15 First, a recap, briefly, of the origins and context of
 16 question (a) in Procedural Order No. 6.
 17 PO No. 6 was, of course, issued simultaneously with
 18 the Court's Award on Competence of the same date, and
 19 against the backdrop of Pakistan's previous submission
 20 of a statement on "Coordination between the Court of
 21 Arbitration and the Neutral Expert". In that statement,
 22 Pakistan had proposed a sequential exercise of functions
 23 between this Court and the parallel Neutral Expert
 24 proceeding as a means of effectively settling the
 25 parties' various differences and disputes with respect

Page 116

14:23 1 to the Treaty, while at the same time ensuring
 2 coordination between the two fora and avoiding the risk
 3 of inconsistent decisions with respect to the same or
 4 related matters.
 5 As the Court noted at the beginning of its analysis
 6 at paragraph 23 of PO No. 6:
 7 "... the dispute presently before the Court arises
 8 in circumstances that have seen both the constitution of
 9 a Court of Arbitration and the appointment of
 10 a Neutral Expert."
 11 The Court continued at paragraph 24, indicating
 12 that:
 13 "It is ... apparent that the dispute placed before
 14 this Court and the matters referred to the Neutral
 15 Expert involve a significant degree of overlap ..."
 16 Namely in respect of what the Court described in
 17 shorthand as "the KHEP/RHEP Design and Operation
 18 Issues"; in other words, issues concerning the
 19 application of the Treaty to the design of India's
 20 Kishenganga and Ratle HEPs.
 21 "At the same time", the Court observed:
 22 "... it is also apparent that the dispute placed
 23 before this Court includes the determination of certain
 24 general questions concerning the interpretation or
 25 application of the Treaty that are not before the

Page 117

14:24 1 Neutral Expert."
 2 This distinction drawn by the Court, between the
 3 general issues of interpretation and application of the
 4 Treaty that are only before this Court and the specific
 5 issues of application of the Treaty that are also before
 6 the Neutral Expert, was emphasised again by the Court at
 7 paragraph 32 of its order.
 8 At paragraph 34 of its order, the Court therefore
 9 decided to organise the proceedings "in phases",
 10 starting with "a series of issues relating to the
 11 interpretation or application of the Treaty that are not
 12 part of the difference before the Neutral Expert".
 13 So that's my first orientation of this question,
 14 which will be familiar, of course.
 15 There is a second point, though, of context to your
 16 question (a): namely, of course, the dispute before you
 17 arises in circumstances where a previous Court of
 18 Arbitration, in the Kishenganga case, and a previous
 19 Neutral Expert, in the Baglihar case, have rendered
 20 decisions which are, in significant parts, mutually
 21 incompatible, and which potentially overlap with parts
 22 of the dispute presently before you.
 23 Indeed, as we will see, those two mutually
 24 incompatible decisions have been cited by the parties'
 25 Indus Waters Commissioners during their discussions

Page 118

14:26 1 since 2013 with respect to pondage and related issues
 2 now before you. Pakistan and its Commissioner have
 3 repeatedly cited the rulings of the Court in the 2013
 4 Kishenganga awards, while India and its Commissioner
 5 have repeatedly cited the earlier 2007 determination of
 6 the Neutral Expert in the Baglihar case.
 7 It's against this backdrop of, first, ongoing
 8 parallel proceedings before a Court and Neutral Expert
 9 and, second, inconsistent previous decisions of a Court
 10 and Neutral Expert that this Court has raised its
 11 question (a). That question essentially concerns the
 12 legal effect of the past decisions of dispute resolution
 13 bodies established pursuant to Article IX of the Treaty,
 14 both upon the parties to the Treaty and upon subsequent
 15 dispute resolution bodies.
 16 (Slide 3) So at this point I can take you to my
 17 first slide, which is Procedural Order No. 6 and the
 18 terms of the question, which merit review before
 19 I continue. But I'm sure they are sufficiently familiar
 20 to the Court for me not to need to read them again into
 21 the record.
 22 Those who are well versed in the Treaty and its
 23 jurisprudence may ask why this question is necessary.
 24 After all, as the Court itself noted in PO No. 6, and as
 25 I will explain, the Treaty provides answers to many

Page 119

14:27 1 aspects of this question, and the jurisprudence, in the
 2 form of the Kishenganga decision, fills in the gaps.
 3 But this question remains of critical importance,
 4 notwithstanding the text of the Treaty and
 5 notwithstanding the clear holdings of the Kishenganga
 6 Court. And it remains of critical importance today for
 7 three reasons.
 8 First India continues to adopt positions which
 9 manifestly contradict the Treaty and its Article IX
 10 jurisprudence, including by refuting the binding and
 11 precedential nature of the awards in the Kishenganga
 12 case, and by asserting a quasi-precedential role for the
 13 earlier Baglihar expert determination, even in respect
 14 of Indian HEPs yet to be designed or constructed on the
 15 Western Rivers. And I will explain my "quasi" reference
 16 shortly, in connection with the quasi-precedential role
 17 given by India to Baglihar.
 18 Second, India continues to rely on Baglihar while
 19 pursuing a parallel proceeding before another Neutral
 20 Expert, which, as PO6 observes, concerns certain design
 21 and operation questions that are essentially identical
 22 to some of the questions before this Court.
 23 And third, this question is critical because,
 24 accordingly, it is inevitable that questions will arise
 25 in both proceedings concerning not only the legal status

Page 120

14:29 1 of previous decisions of the Baglihar Expert and
 2 Kishenganga Court, but questions will also arise
 3 concerning the legal status of previous decisions of
 4 this Court.
 5 Pakistan therefore welcomes the opportunity in this
 6 phase to lay to rest the important systemic issues of
 7 treaty interpretation and application raised by the
 8 Court's question (a).
 9 This Court's decision on question (a) will confirm,
 10 once and for all, the extent to which the previous
 11 decisions of the Baglihar Neutral Expert and the
 12 Kishenganga Court of Arbitration are final and binding,
 13 both for the parties, for the Court of Arbitration and
 14 for the Neutral Expert. The Court's decision on
 15 question (a) will also confirm the binding nature of the
 16 decisions of this Court already made, and that it is yet
 17 to make, in this proceeding.
 18 Already in its Award on Competence, this Court has
 19 made decisions falling within each of the four
 20 categories numbered (i) to (iv) in the Court's
 21 question (a): competence, matters of fact,
 22 interpretation of the Treaty and application of the
 23 Treaty in particular circumstances. The latter two
 24 categories of the Court's question are addressed in the
 25 dispositif of your Competence Award. Elsewhere in your

Page 121

14:31 1 Competence Award, you addressed issue of fact critical
 2 to your competence; and you addressed issues of
 3 competence, of course.
 4 So on my next slide (4), I show the dispositif.
 5 I apologise for the size of the text on this slide, but
 6 I think we don't need to go through the words as such.
 7 It shows the Award on Competence dispositif with
 8 colouring, red and blue, and that's to help orientate
 9 how that decision fits in with the categories of
 10 decision that you identify in question (a). And in
 11 particular, in blue, your decision on competence, those
 12 two paragraphs, B and G, address issues of
 13 interpretation of the Treaty. And in red, there are
 14 a number of decisions on application of the Treaty in
 15 the particular factual circumstances of this case.
 16 So this issue is already live as regards the
 17 consequences of your own decisions so far in this
 18 proceeding.
 19 (Slide 5) I'd like to address for a few minutes the
 20 parties' ongoing differences with regard to the legal
 21 status and relevance of Baglihar and Kishenganga.
 22 The parties' ongoing differences with regard to that
 23 issue are manifest. As subsections 2F.1 and 2F.2 of
 24 Pakistan's Memorial recount, the discussions between the
 25 PCIW, the Pakistani Commissioner, and the ICIW, the

Page 122

14:32 1 Indian Commissioner, particularly with respect to
 2 India's designs of the KHEP and RHEP, provide a fulsome
 3 record of the ongoing disagreement between Pakistan and
 4 India about the legal relevance and precedential value
 5 of the Baglihar and Kishenganga decisions.
 6 In short, first, Pakistan has consistently
 7 maintained that the partial and final awards in
 8 Kishenganga have binding and precedential effect under
 9 the Treaty, both as regards the KHEP and as regards all
 10 other Indian HEPs on the Western Rivers. This flows
 11 from the Court's exclusive role in deciding disputed
 12 questions related to systemic application or
 13 interpretation -- in this case it's systemic
 14 interpretation, of course -- of the Treaty.
 15 The only exception to the precedential effect of the
 16 Kishenganga awards, which was noted by the Court itself
 17 in Kishenganga, is those Indian HEPs that were already
 18 in operation or already under construction, with no
 19 objection by Pakistan, as at 18 February 2013; in other
 20 words, those Indian HEPs that were already in operation
 21 or construction on the Western Rivers, without protest
 22 by Pakistan, as at the date of the Kishenganga partial
 23 award.
 24 So that's Pakistan's approach to Kishenganga.
 25 As regards Baglihar, Pakistan has consistently

Page 123

14:34 1 maintained that the Baglihar determination of
 2 Maître Lafitte has no precedential status or value
 3 beyond the specific issues addressed in that
 4 determination as regards the Baglihar HEP. In other
 5 words, the Baglihar determination has no precedential
 6 status or value at all for other HEPs on the
 7 Western Rivers.
 8 This is because, under the Treaty, Neutral Experts
 9 are not competent to decide disputed questions related
 10 to systemic interpretation or application. They're only
 11 competent to resolve a finite list of technical issues
 12 or disputes identified in the Treaty, and only in
 13 respect of the individual plant or plants at which such
 14 specific disputes have arisen that have been referred to
 15 the relevant Neutral Expert.
 16 So the Neutral Expert in Baglihar was competent,
 17 under Annexure F of the Treaty, to resolve only the
 18 technical disputes between the parties about compliance
 19 of the Baglihar plant with Annex D, paragraphs 8(a)
 20 related to freeboard, 8(c) related to pondage, 8(e)
 21 related to gated spillways and 8(f) related to turbine
 22 intakes; nothing else.
 23 In taking these positions with respect to Baglihar
 24 and Kishenganga, Pakistan has relied both on the
 25 applicable wording of the Treaty and the Court's clear,

Page 124

14:35 1 binding and definitive holdings in Kishenganga about the
 2 contrasting legal status and scope of Court of
 3 Arbitration and Neutral Expert decisions under the
 4 Treaty. So when I address you on the detail of
 5 Pakistan's submission on question (a), I will spend some
 6 time on, first of all, the text of the Treaty, of
 7 course; and second, the relevant paragraphs in the
 8 Kishenganga awards, of which there are a number.
 9 I've looked at Pakistan's consistent positions
 10 vis-à-vis Kishenganga and Baglihar. Turning to India,
 11 by contrast, India consistently dismisses the
 12 precedential value of the Kishenganga awards, including
 13 in connection with its designs for KHEP and RHEP. India
 14 also dismisses those passages in the Kishenganga partial
 15 award that are clear, definitive and binding as regards
 16 the legal status and scope of Court and Neutral Expert
 17 decisions. Instead, India continues to rely on the
 18 previous Baglihar Neutral Expert determination when
 19 attempting to justify its other HEP designs under the
 20 Treaty.
 21 But one very important point to note -- and I will
 22 be taking you to the detail of this in connection with
 23 India's position -- is that India has never gone so far
 24 as asserting that the Baglihar determination is legally
 25 binding beyond the Baglihar plant, whether on a Court of

Page 125

14:39 1 essential to the dispute resolution process under the
 2 Treaty.
 3 It's instructive to pause then here to recall in
 4 more precise terms the record of the Indus Waters
 5 Commission meetings between 2013 and 2015 -- so this is
 6 the meetings held after the Kishenganga awards -- and
 7 the associated correspondence between the parties
 8 shortly before they each commenced the dispute
 9 resolution procedures under Article IX that are ongoing
 10 today. That record demonstrates both the consistency of
 11 Pakistan's positions on issues raised by question (a)
 12 and the limits of India's own position, which was
 13 notably cautious with respect to the legal status of the
 14 Baglihar decision.
 15 So I'm going to take you through four slides which
 16 summarise the positions of each party taken in the Indus
 17 Waters Commission meetings following the Kishenganga
 18 case.
 19 (Slide 6) So first of all, we have the record of the
 20 108th meeting of the Commission in March 2013, dated
 21 24 September; that's P-70.
 22 Here we have consistent statements by the Pakistan
 23 Commissioner as to the "conclusive" nature of the
 24 Kishenganga decision on the question of drawdown
 25 flushing; importantly here, both in respect of plant

Page 127

14:37 1 Arbitration or on the parties with respect to plants
 2 other than Baglihar. Instead, it asserts only that the
 3 determination is a "guideline" for other Indian HEPs on
 4 the Western Rivers, or "authoritative", but not --
 5 explicitly not -- "binding". And we'll see that when
 6 I take you to the record.
 7 This was what I meant earlier when I said that
 8 India's position asserts really that Baglihar only has
 9 quasi-precedential value.
 10 This is telling for the purposes of your
 11 question (a), of course, because, first, even India has
 12 never gone so far as to say that Baglihar has general
 13 binding effect as a matter of law; and second, it
 14 appears that in India's view, especially following the
 15 unfavourable Kishenganga awards, in its view, there is
 16 no dispute resolution body with competence under the
 17 Treaty to render general and binding interpretative
 18 decisions.
 19 This must be wrong. It's nonsensical for the
 20 effective resolution of disputes or the efficient, even,
 21 resolution of disputes even under the Treaty; and, as
 22 I will explain, it is also inimical to doctrines of
 23 res judicata and legal certainty and predictability.
 24 And that latter principle has been recognised both by
 25 the Baglihar Expert and by the Kishenganga Court as

Page 126

14:40 1 specific disputes and "in general for all the future
 2 run-of-river HEPs on the Western Rivers".
 3 And again, in relation to Baglihar, the Pakistani
 4 Commissioner stated that:
 5 "Pakistan did not consider the interpretation
 6 provided by the [Neutral Expert] in Baglihar ... as
 7 a valid interpretation of the Treaty."
 8 Here we see the Indian Commissioner taking
 9 a slightly more cautious position in respect of the
 10 decision on which India relies, namely Baglihar.
 11 He said that:
 12 "... irrespective of the views held by the Pakistan
 13 Commissioner on the [Expert]'s interpretations in
 14 Baglihar ... Pondage is governed by the provisions of
 15 the Treaty."
 16 So at that point there was no explicit reliance on
 17 Baglihar itself for the purposes of the other HEPs under
 18 discussion.
 19 At the next meeting, on the next slide (7) -- or
 20 next but one, the 110th meeting (P-24) -- in 2014, the
 21 Pakistan Commissioner again adopted a consistent
 22 approach. He highlighted the binding quality of the
 23 Kishenganga Court decision, both in respect of
 24 plant-specific disputes and more generally on the
 25 Western Rivers. And he indicated that that extended to

Page 128

14:41 1 the:
 2 "... settled matter that India cannot drawdown the
 3 reservoir below [dead storage level] except in
 4 an unforeseen emergency -- not only [at] Kishenganga ...
 5 but in general for all the future run-of-river HEPs on
 6 the Western Rivers."
 7 He dismissed the reasoning of the Neutral Expert on
 8 the substance in Baglihar and rejected its purported
 9 erga omnes effect by reference to the finding of the
 10 Kishenganga Court on that issue. And he stated that
 11 while the Baglihar Neutral Expert's decision was "final
 12 and binding in respect of the particular matter on which
 13 the decision [was] made", the Neutral Expert's
 14 interpretation on maximum pondage "could not be accepted
 15 as a guideline". And we'll see he picked up that term
 16 from India.
 17 So in the next slide (8), you will see at the same
 18 meeting, the 110th meeting, the Indian Commissioner put
 19 forward as "guideline" the methodology proposed by the
 20 Baglihar Expert for calculating maximum pondage. He
 21 stated that:
 22 "... an unambiguous neutral view is available in the
 23 Baglihar determination which can always serve as
 24 [a] guideline ... [in relation to] all run of the river
 25 [HEPs] on [the] Western Rivers ..."

Page 129

14:43 1 And he noted that:
 2 "Though the determination of pondage by the
 3 Neutral Expert was for Baglihar ..."
 4 So he conceded that point:
 5 "... the same can be considered as [again]
 6 a guideline for other projects of India on the
 7 Western Rivers."
 8 Then at the next meeting, in February 2015, the PCIW
 9 again rejected any broader effect for the Baglihar
 10 decision. And we go to the next slide (9). And these
 11 positions were taken up in correspondence in 2015 and
 12 2016. Here we have the PCIW's letters at P-26 and P-23,
 13 the first one in January 2015, reiterating that
 14 Baglihar:
 15 "... had no general precedential value ... was only
 16 binding in the specific case before him but not in
 17 respect of [other] plants, while the decision of the
 18 Court of Arbitration, by contrast, would be binding
 19 generally for all such plants."
 20 And addressing India's position in his following
 21 letter in February 2016, he said:
 22 "India's reliance upon the Neutral Expert's decision
 23 on pondage with respect to ... Baglihar ... was
 24 'invalid' because [following] Kishenganga ... '(t)he
 25 effect of a neutral expert's determination is restricted

Page 130

14:44 1 to the elements of the design and operation of the
 2 specific ... plant considered by that Expert."
 3 So the parties' position are clear, and the limits
 4 of the Indian position on this issue are clear,
 5 particularly in relation to Baglihar.
 6 But despite the clarity of both the Treaty and the
 7 Kishenganga awards on these issues raised in
 8 question (a), a further final and definitive ruling is
 9 warranted so as to settle this ongoing dispute in
 10 relation to the legal and precedential status of the
 11 Baglihar and Kishenganga determinations.
 12 Otherwise, as the Pakistani Commissioner indicated
 13 in his letter on 25 February 2016 -- I'll just finish
 14 the quote -- he said:
 15 "[India's] positions on these and related issues,
 16 which Pakistan rejects, present legal questions of
 17 Treaty interpretation which will inevitably recur as
 18 India proceeds with other HEP projects on the
 19 Western Rivers."
 20 That's Exhibit P-23.
 21 Thank you for bearing with me, Mr Chairman.
 22 THE CHAIRMAN: No, of course. Thank you, Mr Fietta.
 23 So it may be you are going to get to this in due
 24 course, but while it's clear from the quotes and
 25 extracts you provided the parties' respective positions

Page 131

14:45 1 on Baglihar, it's a little bit less clear to me what
 2 respective positions are on Kishenganga.
 3 Earlier in your presentation, you said that India
 4 "dismisses" the Kishenganga Court's decision. And I'm
 5 wondering: by that, do you mean it basically doesn't
 6 talk about it, or do you mean that they've affirmatively
 7 said it does not have a binding quality with respect to
 8 decisions that are to be taken thereafter with respect
 9 to plants?
 10 MR FIETTA: Thank you for the question.
 11 We will see India's position in a little more detail
 12 as we go to the record in the Kishenganga proceeding,
 13 which of course looked at this issue, and even on the
 14 request for interpretation of that decision, of the
 15 partial award.
 16 India's position certainly is that -- it does not
 17 repeatedly and expressly dismiss the precedential value
 18 of the Kishenganga award. One would assume that that
 19 may be because it is aware of the weakness of its legal
 20 position. It's clear though that its position on the
 21 Baglihar determination completely disregards any
 22 precedential value for the Kishenganga award. Because
 23 if the Kishenganga award had general precedential value
 24 and was dispositive, for example, on the question of
 25 drawdown flushing, then India would not be able to adopt

Page 132

14:47 1 the position it does, in reliance still on Baglihar, in
 2 connection with that issue.
 3 We will see though the precise wording, as far as
 4 India is willing to go in connection with that issue,
 5 when we look at the record from the Kishenganga case.
 6 THE CHAIRMAN: Well, I'm interested in what's happening
 7 post-Kishenganga. Whatever they might have said before
 8 the Kishenganga Court isn't directly speaking to the
 9 issue of India's posture after the Court of Arbitration
 10 issues its decision.
 11 From what you've said so far, it sounds as though
 12 they have never, in your reading of the record,
 13 expressly said that the Kishenganga Court's
 14 determination/judgment/award does not have precedential
 15 effect; it's more in the nature of simply not giving it
 16 much attention in the course of the interactions between
 17 the parties. Is that a correct understanding?
 18 MR FIETTA: Well, it is clearly -- I think Pakistan's
 19 position has been very clear as regards the precedential
 20 effect of Kishenganga. And in those meetings, India has
 21 certainly never agreed in any way with that position.
 22 I will check one last time for you before next week.
 23 My understanding of the record is though -- because
 24 I don't want to make a definitive statement -- but my
 25 clear understanding of the record on that point is that

Page 133

14:50 1 he or she need not be -- and invariably will not be --
 2 a lawyer, at least not a lawyer skilled in the
 3 interpretation and application of treaties.
 4 As such, while a Neutral Expert may have to engage
 5 in some Treaty interpretation in order to resolve
 6 a technical dispute with relation to a specific HEP
 7 under Annexure F, he or she cannot do so on a systemic
 8 basis, or in any way that is generally binding on the
 9 parties and other dispute resolution bodies under the
 10 Treaty. The decision only goes so far as the particular
 11 HEP concerned.
 12 Unfortunately, the Neutral Expert in the Baglihar
 13 case, Maître Lafitte, did take it upon himself to engage
 14 in a lengthy and in some ways questionable Treaty
 15 interpretation exercise. He extended that analysis of
 16 international law under the Vienna Convention,
 17 et cetera, far beyond the technical paragraphs at issue
 18 under Annexure D, into putative interpretations of the
 19 Treaty's preamble, its object and purpose, of
 20 Article III, of Article XI, of Article XII. And he
 21 included in his determination, as you will know,
 22 a seven-page section, section 5.1, specifically on the
 23 topic of Treaty interpretation; not in relation to
 24 Annexure D at all, and the specific technical issues
 25 that he was concerned with, but much more broadly in

Page 135

14:49 1 India has never made a legal statement in those terms
 2 denying the precedential effect of the Kishenganga
 3 determinations under the Treaty. But I will check, as
 4 a matter of fact, on that point.
 5 I think -- and this is the tenor of my submission --
 6 that India's position is much more nuanced and carefully
 7 framed so as to avoid expressly making out that
 8 position. But I will confirm it, if needed, next week.
 9 One final point before I get to the detail of
 10 question (a). Pakistan's consistent position, which
 11 aligns with the position of the Court in Kishenganga
 12 about the respective legal and precedential value of
 13 Court of Arbitration and Neutral Expert decisions,
 14 Pakistan's position makes eminent sense: from
 15 a skill-set, from a competence and from a policy
 16 perspective.
 17 Courts of Arbitration, as we know, are by definition
 18 multidisciplinary and comprised of at least five --
 19 otherwise seven, as in Kishenganga -- individuals, with
 20 a mix of international law and engineering expertise.
 21 They are inherently qualified to resolve questions of
 22 Treaty interpretation and application on both
 23 a plant-specific and systemic, generic basis.
 24 By contrast, any Neutral Expert is a single
 25 individual who must be a highly qualified engineer. But

Page 134

14:52 1 connection with the issues that I described.
 2 The seven-member Court of Arbitration in Kishenganga
 3 unanimously confirmed later that his approach was
 4 "misplaced" and wrong in law. Among other errors, he
 5 strayed into purporting to interpret the Treaty
 6 provisions that were plainly not within his competence.
 7 He took a superficial view of the Treaty's object and
 8 purpose and the circumstances of its conclusion. And in
 9 passages that were explicitly rejected by the Court of
 10 Arbitration, he determined that any interpretation of
 11 Annexure D must take into account the state-of-the-art
 12 design and the best and latest practices in the field of
 13 construction and operation of hydroelectric plants.
 14 As we've seen, India has repeatedly cited that
 15 determination as a "guideline", including in connection
 16 with India's KHEP and RHEP, notwithstanding the fact
 17 that it was unanimously rejected by the Kishenganga
 18 Court as being both inconsistent with a proper
 19 interpretation of the Treaty and of no precedential
 20 value beyond the Baglihar plant. As we'll explain, the
 21 Kishenganga Court's holdings in that regard, unlike
 22 those of the Baglihar Neutral Expert, are of general
 23 binding and otherwise controlling effect.
 24 So the distinction between the competencies of
 25 Courts of Arbitration and Neutral Experts also serves to

Page 136

14:53 1 avoid inconsistent decisions being made with respect to
 2 the generic matters of Treaty interpretation or
 3 application.
 4 This isn't to say that some specific matters, such
 5 as those of a technical nature related to the design of
 6 a particular HEP, it's not to say that those issues
 7 cannot be before both a Court and a Neutral Expert at
 8 the same time, where the necessary mutual consent of the
 9 parties exists. This much is acknowledged in your own
 10 Procedural Order No. 6. But as the Court continued in
 11 its PO6 after paragraph 28, you said:
 12 "In such circumstances, there is a general duty ...
 13 to exercise ... competence in such a manner as to
 14 facilitate the actual resolution of the Parties' dispute
 15 and to avoid the risks of duplicative proceedings or
 16 conflicting decisions."
 17 And you then said that a general duty of "mutual
 18 respect and comity" applies.
 19 And as the Baglihar determination and Kishenganga
 20 awards show, the fact that a Neutral Expert has reached
 21 one conclusion on interpretation of the Treaty with
 22 respect to a specific plant does not prevent a Court of
 23 Arbitration from later reaching a different conclusion
 24 with respect to the general interpretation or
 25 application of the Treaty. In such a situation, it is

Page 137

14:55 1 the interpretation of the Court, not the earlier
 2 interpretation of the Neutral Expert, which is binding
 3 for all future Indian plants on the Western Rivers.
 4 So I now turn to the detail of Pakistan's response
 5 to question (a).
 6 The question, as we will see, is on the screen
 7 again. We are on slide 10. It requires consideration
 8 of the binding or other controlling effects of four
 9 types of Court of Arbitration decision, numbered (i) to
 10 (iv) there; and four types of Neutral Expert decision
 11 too, the same categories. And it requires analysis of
 12 those four types of decision across the two different
 13 fora from four perspectives, and that's the perspectives
 14 (a) to (d): the parties, the present proceedings, the
 15 present proceedings before the Neutral Expert and future
 16 proceedings.
 17 So there's quite a few -- if you unpackage it --
 18 quite a few questions there. And I'm not going to spend
 19 lots of time addressing all of them, because there is
 20 some overlap, but I am going to answer all of them.
 21 But for your benefit -- and it's something that you
 22 don't need to read in detail now, but I have prepared
 23 for you a matrix at the back of your handout; I think
 24 it's tab 8. There's two matrices summarising Pakistan's
 25 answers on each of the 16 questions, effectively, that

Page 138

14:57 1 you have posed in relation to, first of all, Courts of
 2 Arbitration, the binding effect of Court of Arbitration
 3 decisions; and secondly, the binding effect, or not, of
 4 Neutral Expert decisions.
 5 I'm going to take you through the reasoning set out
 6 in each of those matrices and I'll take you through each
 7 of the Treaty provisions and each of the decisions in
 8 paragraphs that we cite to there. And there's a simple
 9 colour code, just for your ease of reference later,
 10 where the green indicates binding decisions, the blue
 11 indicates binding decisions with respect to matters
 12 within the competence of a Neutral Expert and the red
 13 indicates non-binding decisions.
 14 I'm going to take you through our reasoning as
 15 reflected and summarised in those matrices. But I just
 16 wanted to make sure we answered every one of the
 17 32 questions implied in question (a).
 18 So the remainder of my presentation will address
 19 question (a) with respect to, first, the decisions of
 20 a Court of Arbitration, and that's matrix 1; and second,
 21 decisions of a Neutral Expert, that's matrix 2. By the
 22 conclusion of my presentation, I will have led you
 23 through all of the salient elements of each of those
 24 matrices and I'll make some concluding remarks.
 25 (Slide 11) So first of all, I'm going to address the

Page 139

14:58 1 "binding or otherwise controlling effect" of decisions
 2 of a Court of Arbitration.
 3 Examining first then these Court of Arbitration
 4 decisions. As explained in our Memorial at
 5 paragraphs 8.62 to 8.69, the binding character on the
 6 parties of the decisions of a Court of Arbitration is
 7 explicitly confirmed by the relevant paragraphs of
 8 Annexure G. And that is my next slide (12),
 9 paragraphs 16 and 23.
 10 Paragraph 23 makes clear that any award rendered by
 11 a Court of Arbitration in accordance with the provisions
 12 of Annexure G in regard to a dispute is "final and
 13 binding on the Parties with respect to that dispute".
 14 Now, what is a "dispute"? Under Article IX of the
 15 Treaty, a "dispute" can arise out of:
 16 "Any question ... concerning the interpretation or
 17 application of this Treaty or the existence of any fact
 18 which, if established, might constitute a breach of this
 19 Treaty ..."
 20 So on the face of Article IX, differences of
 21 questions of fact, questions of interpretation,
 22 application of the Treaty and of course competence are
 23 all capable of forming "disputes" for the purposes of
 24 paragraph 23. Decisions of a Court of Arbitration on
 25 all of those matters are therefore final and binding on

Page 140

15:00 1 the parties.
 2 As for decisions relating to competence,
 3 paragraph 16 of Annexure G there provides that:
 4 "Subject to the provisions of this Treaty and except
 5 as the parties may otherwise agree, the Court shall
 6 decide all questions relating to its competence ..."
 7 Such decisions are made in the form of awards, like
 8 this Court's Award on Competence dated 23 July last
 9 year, and are thus equally binding on the parties by
 10 virtue of paragraph 23.
 11 As paragraph 23 makes clear, the formal requirements
 12 of any "award" are simple: it must be in writing; it
 13 must be accompanied by a statement of reasons; signed by
 14 four or more members of the Court; and delivered by the
 15 Court to each party in signed form.
 16 So these paragraphs are determinative as regards
 17 those parts of question (a) concerning the parties in
 18 relation to Courts of Arbitration. And this plainly
 19 applies to any form of award, including an award on
 20 competence, a partial award, a final award, like those
 21 in Kishenganga, or any other award "on the issues in
 22 dispute". And in fact, at paragraphs 123 and 189 of
 23 last year's Competence Award, you explicitly confirmed
 24 the binding nature of the Kishenganga awards on India
 25 and Pakistan as parties.

Page 141

15:01 1 The binding quality of the Court's decisions more
 2 generally, including on subsequent Courts of Arbitration
 3 or Neutral Expert proceedings under the Treaty, follows
 4 from a combination of the Court's broad competence to
 5 resolve disputes under Article IX and paragraph 23 of
 6 Annexure G and the res judicata effect of its decisions
 7 as a matter of basic international law. As I'll explain
 8 shortly, this was explicitly confirmed by the Court --
 9 and tacitly acknowledged even by India -- in the
 10 Kishenganga case.
 11 So this was again a tacit reference -- to go to your
 12 question -- by India as regards the role of
 13 res judicata. But again, it was a tacit position;
 14 it wasn't explicit, as we will see.
 15 As a matter of plain meaning and object and purpose,
 16 an award that's "final and binding" on the parties, and
 17 which thus finally "resolves" a dispute under the
 18 Treaty, must also be binding on other dispute resolution
 19 mechanisms which may be seised of disputes or other
 20 differences under the same Treaty, whether in parallel
 21 or in future. Otherwise, the final and binding nature
 22 of a Court's award, and the ability of a Court to
 23 resolve the dispute, would be critically undermined,
 24 because the parties could circumvent an award simply by
 25 engaging in fresh dispute resolution procedures under

Page 142

15:03 1 Article IX.
 2 This is the crux of res judicata. That doctrine, as
 3 Pakistan says in its Memorial at paragraph 8.70,
 4 "precludes re-litigation of the same subject matter
 5 between the same parties in later proceedings".
 6 Res judicata is a general principle of law -- and
 7 this is my next slide (13) -- a general principle of law
 8 applicable throughout international judicial
 9 proceedings.
 10 THE CHAIRMAN: Mr Fietta, before you move on, if you could
 11 go back to the prior slide (12). And if you plan to
 12 address this later on, that's fine. But I'm wondering
 13 if you could say a few words about what constitutes the
 14 award.
 15 The award could be the entire decision that's been
 16 rendered, from paragraph 1 through to the dispositif;
 17 it could be just the dispositif. And this language at
 18 paragraph 23 that says, "The Award shall be accompanied
 19 by a statement of reasons" might be read to mean that
 20 the award is something like the dispositif, but not the
 21 reasons. And this seems relevant when we're then
 22 thinking about the res judicata effect of the award.
 23 So if you have thoughts in that regard, I'd welcome
 24 them.
 25 MR FIETTA: Yes.

Page 143

15:04 1 So the award as a whole, is the easy part, I guess,
 2 so long as it's rendered in accordance with the
 3 provisions of the annexure, "shall be final and
 4 binding". It's final and binding "with respect to [the]
 5 dispute". And the dispute can extend to disputes
 6 related to issues of fact, law, application of law and
 7 the Treaty to specific plants.
 8 So to the extent that the provisions in the award
 9 resolve the dispute, we say they are final and binding
 10 on the parties. That will extend beyond the dispositif
 11 of the award, into other relevant holdings of the Court
 12 that underpin the dispositif in the award and that
 13 resolve the dispute, all of the disputed issues between
 14 the parties, whether they be issues of fact, law or
 15 application.
 16 I am coming on to this also in connection with the
 17 principle of res judicata, because there is a debate
 18 within international law as to the extent of
 19 res judicata: does it extend beyond the pure wording of
 20 the dispositif of a decision? And I will be taking you
 21 to some jurisprudence which indicates that does.
 22 But our starting point is the wording of the Treaty,
 23 and that the "final and binding" nature of an award
 24 covers all of the issues in dispute.
 25 The point on res judicata is more explicit in saying

Page 144

15:06 1 that to the extent necessary to understand the reasoning
 2 behind the decision in the dispositif, then other parts
 3 of an award can be treated as res judicata, and I'll be
 4 taking you to the recent Colombia v Nicaragua decision
 5 in relation to that issue.
 6 THE CHAIRMAN: So you don't see any significance in the
 7 wording here in paragraph 23 that, "The Award shall be
 8 accompanied by a statement of reasons", rather than
 9 saying, "The Award shall include a statement of
 10 reasons"?
 11 MR FIETTA: No. I think it would be overly artificial to
 12 indicate or to expect that an award under paragraph 23,
 13 that the award proper would be limited to the two
 14 paragraphs that might appear in the dispositif, and that
 15 the rest is simply a statement of reasons which has no
 16 legal impact and no binding effect between the parties.
 17 And I think that certainly would be inconsistent with
 18 the jurisprudence on res judicata, which does indicate
 19 that the underlying reasons themselves can form part of
 20 the res judicata. Because otherwise, the final and
 21 binding effect of the decision itself will be put in
 22 jeopardy.
 23 So, for example, in your Award on Competence you
 24 reached a number of findings on fact in your underlying
 25 analysis: as regards the constitution of the Court, for

Page 145

15:09 1 the nature of the principle of res judicata.
 2 The award, back in 1941, indicated:
 3 "That the sanction of res judicata attaches to
 4 a final decision of an international tribunal is
 5 an essential and settled rule of international law.
 6 If it is true that international relations based on
 7 law and justice require arbitral or judicial
 8 adjudication of international disputes, it is equally
 9 true that such adjudication must, in principle, remain
 10 unchallenged if it is to be effective to that end."
 11 And even before Trail Smelter, of course, there were
 12 many other decisions that Trail Smelter cited, from
 13 previous jurisprudence from the Permanent Court of
 14 International Justice and otherwise.
 15 So status of the principle in law is unshakable and
 16 essentially unchallenged.
 17 (Slide 14) As to the meaning of the doctrine of
 18 res judicata, Bin Cheng cites back to the Société
 19 commerciale de Belgique case back in 1939:
 20 "... [it] means nothing else than recognition of
 21 the fact that the terms of that award are definitive and
 22 obligatory."
 23 And in its pure sense, to go to your question,
 24 res judicata in its purest sense applies to the
 25 operative clause. But it certainly does not end at the

Page 147

15:07 1 example. Your dispositif said that was in accordance
 2 with the Treaty. But the factual findings as to the way
 3 in which the Court had been constituted were also final
 4 and binding: they could not be challenged or reopened by
 5 another attempt to refer the dispute to a third party
 6 under Article IX. If a party could have reopened those
 7 findings of fact in the main body of your Award on
 8 Competence, then the res judicata of your decision on
 9 competence would be fatally undermined, potentially.
 10 THE CHAIRMAN: Thank you. And again, you may be getting to
 11 this in due course. But I take it what you're saying
 12 is: it's not just the dispositif; it does include
 13 aspects of the reasoning underlying what is determined
 14 in the dispositif. There may be other aspects of the
 15 award that are not directly germane to the outcome that
 16 might not have res judicata effect. Is that the way
 17 you're seeing it?
 18 MR FIETTA: That's correct. Yes, that is correct.
 19 (Slide 13) So res judicata is a general principle of
 20 law, as I was saying, applicable throughout
 21 international judicial proceedings; confirmed by
 22 Bin Cheng, of course, in his seminal work (PLA-95),
 23 which will be familiar to some members of the Court,
 24 which appears on my slide. And he cites the no less
 25 seminal Trail Smelter award as one of many which confirm

Page 146

15:10 1 operative clause, as I was saying, or the dispositif.
 2 (Slide 15) And the ICJ looked at this point quite
 3 recently in the Delimitation of the Continental Shelf
 4 beyond 200 miles -- that's PLA-108, and the relevant
 5 paragraphs are on your slide -- and it did so in order
 6 to ascertain the meaning and scope of res judicata in
 7 the dispositif. It said (paragraph 59) that:
 8 "... it is also necessary to ascertain the content
 9 of the decision, the finality of which is to be
 10 guaranteed."
 11 And the court continued by observing, in the
 12 highlighted text (paragraph 61):
 13 "... in order to ascertain what is covered by
 14 res judicata, it may be necessary to determine the
 15 meaning of the operative clause by reference to the
 16 reasoning set out in the judgment in question."
 17 And of course, in that case the court was faced with
 18 such a situation, because Nicaragua and Colombia
 19 disagreed fundamentally on the operative clause of the
 20 earlier decision in the case between them in 2012. And
 21 therefore the court analysed the underlying rationale of
 22 that decision in the main body of the 2012 judgment in
 23 order to assess whether or not the question before them
 24 in the new case was res judicata or not. And it
 25 decided, having looked at the underlying rationale of

Page 148

15:12 1 the decision in 2012, that the new case was not
 2 res judicata.
 3 (Slide 16) The ICJ has also explained the basic
 4 rationale for res judicata. In the Bosnian Genocide
 5 case, for example, PLA-109 (paragraph 116), the court
 6 said:
 7 "The Court's function, according to Article 38 of
 8 its Statute, is to 'decide', that is, to bring to
 9 an end, 'such disputes as are submitted to it' ...
 10 Depriving a litigant of the benefit of a judgment it has
 11 already obtained must in general be seen as a breach of
 12 the principles governing the legal settlement of
 13 disputes."
 14 The key word with reference to the statute there was
 15 "decide". For your purpose, the key word is "resolve",
 16 under the Indus Waters Treaty. And we say that the task
 17 of resolving a dispute is directly analogous -- it's the
 18 same -- as the task of deciding a dispute at the ICJ
 19 under its statute.
 20 Notably for purposes of question (a), in the
 21 following paragraph, paragraph 117, the ICJ confirmed
 22 that the res judicata doctrine applied to questions of
 23 competence or jurisdiction, just as it applied to
 24 questions of merit. (Pause)
 25 THE CHAIRMAN: Mr Fietta, since you've paused, I'll jump in.

Page 149

15:15 1 As the Kishenganga Court acknowledged in its partial
 2 award, "stability and predictability ... are vitally
 3 important for the effective utilization of rights
 4 accorded to each Party by the Treaty". And that's
 5 PLA-3, paragraph 457.
 6 Related doctrines of good faith are also relevant.
 7 It's difficult to see how a Court of Arbitration or
 8 a Neutral Expert could in good faith disregard the final
 9 and binding decisions contained in the award of
 10 a previous Court of Arbitration.
 11 Pakistan's submission on the binding quality of the
 12 Court's decisions, both in respect of plant-specific
 13 disputes and more generally with respect to Indian HEPs
 14 on the Western Rivers, is confirmed by a close
 15 examination of the Kishenganga case. So we'll turn to
 16 that now.
 17 In that case, the Court addressed two threshold
 18 questions: namely, the legality under the Treaty of
 19 a proposed diversion of the Kishenganga; and secondly,
 20 the permissibility under the Treaty of drawdown flushing
 21 at the Indian HEPs on the Western Rivers.
 22 On my next slide, slide 17, in its partial award and
 23 final award in relation to that first question,
 24 diversion, the Court rejected the plant-specific
 25 declaration requested by Pakistan and proceeded to make

Page 151

15:13 1 And this question may be one that's better addressed by
 2 Professor Tanzi on Friday when he takes to the podium.
 3 But I'm curious if there are examples where the text
 4 of a judgment or an award are cross-referenced in
 5 a dispositif in a way that that to some extent addresses
 6 this issue that we've been talking about, where it's
 7 quite clear from the dispositif itself that there's
 8 particular reasoning that is pertinent to that
 9 conclusion in the dispositif. If there are such
 10 examples, I'd welcome Pakistan informing the Court about
 11 them.
 12 MR FIETTA: Yes, indeed. Professor Tanzi will be addressing
 13 you on the narrative dispositif, and that would very
 14 much encapsulate such a technique, potentially, in the
 15 drafting of a dispositif. So I'm sure we will come back
 16 to that later in the week.
 17 THE CHAIRMAN: Thank you.
 18 MR FIETTA: In short, the recognition of judgments or awards
 19 of competent international courts and tribunals as being
 20 "definitive and obligatory", in the words of the PCIJ,
 21 and thus res judicata, is essential for the
 22 effectiveness of adjudication and consequently for the
 23 stability of international legal relations. It is no
 24 less essential to the system of adjudication under the
 25 Indus Waters Treaty.

Page 150

15:16 1 a series of decisions relating to the application of the
 2 Treaty to the specific circumstances of the KHEP. And
 3 they are summarised on the slide here at paragraph A of
 4 the dispositif.
 5 In relation to the second question -- that is,
 6 drawdown flushing -- the Court rendered a general
 7 interpretative declaration, and it's clearly on its face
 8 a general declaration.
 9 We can go to the next slide (18). That general
 10 declaration indicated that "the Treaty does not permit
 11 reduction below Dead Storage Level of the water level in
 12 the reservoirs", except in cases of unforeseen
 13 emergency, of course. And the Court proceeded to hold
 14 that "the accumulation of sediment in the reservoir of
 15 a run-of-river plant on the Western Rivers" did not
 16 constitute such an emergency.
 17 So that's dispositifs B(1) and (2). And the Court
 18 then proceeded at dispositif B(3) to issue
 19 a plant-specific instruction to India on the back of
 20 those generic holdings, namely not to employ drawdown
 21 flushing at the reservoir of the KHEP to an extent that
 22 would entail depletion of the reservoir below dead
 23 storage level.
 24 (Slide 19) The Court emphasised earlier in the
 25 partial award that the scope of the second question

Page 152

15:18 1 about drawdown flushing was general in nature, and that
 2 its rulings would apply to future HEPs on the Western
 3 Rivers. And you can see that in this quotation from
 4 paragraph 466, for example, where the Court said that:
 5 "The question facing the Court is therefore whether
 6 the Treaty prohibits drawdown flushing by India at the
 7 KHEP and at other, future Run-of-River Plants on the
 8 Western Rivers."
 9 The generic nature of the Court's decision on the
 10 legality of drawdown flushing was emphasised repeatedly
 11 in the Court's subsequent decision on the request for
 12 clarification or interpretation; that's PLA-21.
 13 Notably, this request was brought by India in the
 14 Kishenganga case.
 15 (Slide 21) Paragraph 25 of the decision on the
 16 request indicated that:
 17 "With respect to the scope of the question submitted
 18 and discussed by the Parties, this Court considers it to
 19 be beyond doubt that the permissibility of drawdown
 20 flushing was put before the Court as a general issue."
 21 In other words, it had been part of the dispute, and
 22 the parties had made submissions in relation to that
 23 general dispute.
 24 And at paragraph 27, the next slide (22):
 25 "Faced in the Second Dispute with a question of

Page 153

15:19 1 interpretation centred on the general meaning and
 2 application of a particular provision ... and its
 3 relationship with the Treaty as a whole, the Court's
 4 answer to it was general as well and not limited to the
 5 KHEP ... The inclusion of such an express
 6 limitation ..."
 7 Well, I'll come to that point actually, the express
 8 limitation point, in a second.
 9 India itself acknowledged the generic nature of the
 10 Court's decision in Kishenganga as regards the legality
 11 of drawdown flushing. As we can see on my next slide
 12 (23), in its request for clarification or interpretation
 13 of the partial award on 18 May 2013 (P-548), India
 14 explained that its application was motivated by the fact
 15 that the partial award had set out a general prohibition
 16 against the use of "drawdown flushing for sediment
 17 control in all future Run-of-River plants". This is
 18 from India's own application.
 19 India thus requested clarification or interpretation
 20 in an attempt to preserve an ability to reduce water
 21 levels below dead storage during drawdown flushing at
 22 other Western Rivers sites in the future. That's clear
 23 from paragraph 3 of the Indian application. And that's
 24 perhaps, on the record that we have, the clearest
 25 indication that at least before the decision on the

Page 154

15:21 1 request for clarification/interpretation, India did
 2 acknowledge the generic binding effect of the Court's
 3 findings. It's only after it lost on this application
 4 that it adopted a different position and stepped away
 5 from that acknowledgement of the binding effect of the
 6 Kishenganga award beyond the KHEP.
 7 (Slide 24) As we have seen, the Court was unmoved by
 8 India's request for interpretation and clarification.
 9 At paragraph 34 of its decision on India's request, the
 10 Court emphasised again, as it had in its underlying
 11 partial award, the generic nature of its prohibition
 12 against drawdown flushing at Indian HEPs on the Western
 13 Rivers. It held that the prohibition constituted
 14 a "regulatory consideration" which formed "part of the
 15 Treaty's essential bargain", and which would bind India
 16 when assessing sites for all future HEPs.
 17 So this is a point to which Sir Daniel took you,
 18 I think, yesterday: the fact that this "essential
 19 bargain" is one of the regulatory constraints on the
 20 construction of HEPs and design of HEPs under the
 21 Treaty, and it may be that it does preclude India from
 22 building HEPs at certain locations, and instead having
 23 to choose others where drawdown flushing is not
 24 required. But the prohibition under the Treaty is
 25 clear, and the generic effect of the Kishenganga's

Page 155

15:23 1 award's decision on that prohibition was emphasised
 2 again in this decision on clarification/interpretation.
 3 It's notable that these passages refer throughout to
 4 the binding nature of the Court's decision across plants
 5 as a whole. In effect, therefore, the Court's decision
 6 was to be binding both as regards the parties and as
 7 regards future Neutral Expert or Court proceedings.
 8 Otherwise, the Court's operative decision with respect
 9 to the prohibition against drawdown flushing under the
 10 Treaty would have been deprived of any res judicata
 11 effect.
 12 Turning back to the partial award dispositif,
 13 I'm going to take you to a question of exception and
 14 limitation, which is a separate part of your
 15 question (a): to what extent are there exceptions or
 16 limitations to the final and binding effect of decisions
 17 of a Court of Arbitration? And the Kishenganga partial
 18 award is illustrative on this point.
 19 (Slide 25) It concerns the fourth paragraph of the
 20 dispositif in the Court's award (PLA-3), highlighted
 21 here. And it's an exception to the general binding
 22 effect of the Kishenganga Court's rulings with respect
 23 to the issues before them, namely that those rulings
 24 would not apply to Indian HEPs on the Western Rivers
 25 that were "in operation at date of issuance of this

Page 156

15:24 1 Partial Award". So the prohibition on drawdown flushing
 2 would not apply to Indian HEPs on the Western Rivers
 3 that were in operation already on the date of issuance
 4 of this partial award, or that were already under
 5 construction as at that date, "the design of which,
 6 having been duly communicated by India ... had not been
 7 objected to by Pakistan" under Annexure D.
 8 This was the first of two limitations or exceptions
 9 to the res judicata nature of the Court's awards in
 10 Kishenganga. And this important proviso to the systemic
 11 interpretation on drawdown flushing was sound from
 12 a legal perspective, not least in recognising the
 13 res judicata effect of the earlier Baglihar decision for
 14 the Baglihar HEP. It was also essential from
 15 a practical perspective, because any retrospective
 16 application of the decision would have had enormous
 17 adverse consequences for India, of course, with respect
 18 to other HEPs already in operation by the time of the
 19 Kishenganga award.
 20 So this proviso at paragraph B(4) goes directly to
 21 your question about exceptions and limitations. That
 22 is, Courts of Arbitration, in rendering systemic
 23 interpretations, should be mindful of the res judicata
 24 effect of previous final and binding decisions,
 25 including of Neutral Experts, with respect to specific

Page 157

15:28 1 clear that -- except where so limited -- the Court's
 2 Decision applies to Run-of-River Plants generally."
 3 There's some more context about that aspect of the
 4 decision at paragraph 523 (PLA-3), on my next slide
 5 (27):
 6 "It would not be in accordance with the governing
 7 principles enunciated in this Partial Award for the
 8 interpretation of the Treaty, and its application, to
 9 cast doubt retrospectively on ... Plants already in
 10 operation ..."
 11 So you can see the rationale for that limitation
 12 there.
 13 I've spent some time addressing the question of
 14 permissibility of drawdown flushing at Indian HEPs
 15 because it's the most notable exercise, perhaps, by the
 16 Kishenganga Court of a generic interpretative exercise
 17 and the exercise of that competence under the Treaty.
 18 Moreover, that general interpretative competence was
 19 exercised against the backdrop of a contrary decision of
 20 the Neutral Expert, of course, and in a context where
 21 India itself acknowledged the general interpretative
 22 competence of a Court of Arbitration in the context of
 23 its request for interpretation, as compared with the
 24 plant-specific competence of a Neutral Expert on the
 25 same question.

Page 159

15:26 1 HEPs, and they should avoid casting doubt
 2 retrospectively on those Indian run-of-river plants that
 3 are already in operation on the Western Rivers.
 4 THE CHAIRMAN: It may be a fine point Mr Fietta, but is this
 5 really an exception to res judicata effect, as opposed
 6 to the Court reaching a judgment that excluded certain
 7 matters, and the res judicata then is that it reaches
 8 some matters and not others?
 9 MR FIETTA: Yes, I think there is a discussion to be had
 10 around that issue. As regards the generic
 11 interpretation and the final and binding effect of the
 12 drawdown flushing holding, it was an exception; but it
 13 was an explicit exception or limitation to that generic
 14 holding, which itself formed part of the dispositif, and
 15 therefore is res judicata. So, yes, I take the point.
 16 Of course, paragraph B(4) was only required because
 17 the Court's interpretative holdings under B(1) and B(2)
 18 that we saw earlier were otherwise of general
 19 application. And the Court recognised this in its
 20 subsequent decision on clarification or interpretation
 21 in the passage that we saw a moment ago. (Pause)
 22 (Slide 26) Yes, and then there's reference to B(4)
 23 that we just looked at. This was in the subsequent
 24 decision on interpretation (PLA-21):
 25 "The inclusion of such an express limitation makes

Page 158

15:29 1 So as such, the history related to the question of
 2 drawdown flushing is of great assistance, we say, to the
 3 Court's question (a), both as regards the general
 4 interpretative competence exercised by the Court under
 5 the Treaty in that case and as regards the more limited
 6 interpretative competence of Neutral Experts, to which
 7 I will return shortly.
 8 Now, aside from the issue of drawdown flushing, the
 9 Kishenganga Court made a series of other important and
 10 binding interpretative decisions.
 11 (Slide 28) These included, first of all, with
 12 respect to the duty of Courts of Arbitration to
 13 interpret and apply the Treaty in light of rules and
 14 principles of international law; a duty which would be,
 15 of course, both unrealistic and inappropriate for
 16 a Neutral Expert engineer when deciding a plant-specific
 17 issue. That's at paragraph 452. And therefore the
 18 Court said it was incumbent on it to interpret and apply
 19 the Treaty in light of those customary international law
 20 principles.
 21 This is obviously with reference also to
 22 paragraph 29 of Annexure G, of which there is no
 23 equivalent, of course, in Annexure F, relating to
 24 Neutral Experts.
 25 (Slide 29) The Court also made definitive findings

Page 160

15:31 1 in relation to the let-flow obligation and the division
 2 of the six main watercourses under the Treaty as
 3 a "defining characteristic of the Treaty", and in that
 4 context that:
 5 "... Pakistan is given priority in the use of the
 6 waters of the Western Rivers, just as India has priority
 7 in the use of ... the Eastern Rivers."
 8 (Slide 30) And importantly, given the Court's
 9 question (a), it made an interpretative holding that
 10 only awards of a Court of Arbitration have general
 11 binding effect under the Treaty, in contrast with the
 12 technical plant-specific determinations of a Neutral
 13 Expert. That's paragraph 470. And I think this is
 14 a good example of where the rationale underpinning the
 15 Court's generic holding on drawdown flushing and its
 16 explicit overruling, effectively, moving forward, of the
 17 Baglihar decision is explained through the reasoning of
 18 the award and forms a part, we would say, of the
 19 res judicata of the award.
 20 (Slide 31) The Kishenganga final award also
 21 reiterated the pertinence of the principle of
 22 res judicata. You'll recall the Court was devoted
 23 largely to setting minimum flows in its final award at
 24 the Kishenganga/Neelum River, to be released during the
 25 operation of the KHEP.

Page 161

15:34 1 Now, unsurprisingly, given the overriding importance
 2 of stability and predictability under the Treaty, and
 3 the otherwise binding nature of Court of Arbitration
 4 decisions, the Court set a high threshold for any such
 5 reconsideration in the future: "reasoning [that] no
 6 longer accords with reality". So the reasoning of the
 7 decision must no longer really make sense in the new
 8 circumstances.
 9 Although it's difficult to anticipate exactly when
 10 such a threshold might be met, one can imagine that
 11 climate change might present a situation in which
 12 an interpretation or application of the Treaty could be
 13 superseded by subsequent events, as indicated explicitly
 14 by paragraphs 117 and 118 of the final award in
 15 Kishenganga.
 16 So that takes me to the end of my submissions on the
 17 Court. I'm then going to move on to the Neutral Expert,
 18 on which I will be briefer because a number of the
 19 points I made will apply equally to the Neutral Expert.
 20 THE CHAIRMAN: Thank you, Mr Fietta.
 21 I do have a question for you on the slide that was
 22 just up on the screen (31). And my question is whether
 23 this concept of the res judicata effect not extending
 24 beyond the life of the award in certain circumstances is
 25 a broader potential exception than what is indicated

Page 163

15:32 1 Between paragraphs 117 and 119 of the final award,
 2 the Court noted the importance of res judicata under the
 3 Treaty in ensuring "stability and predictability".
 4 However, the Court went on to say that future flows
 5 upstream may come to differ significantly from the
 6 historic record as a result of factors beyond the
 7 control of either party. The Court therefore
 8 proactively put in place a mechanism for future
 9 reconsideration of its decision on the minimum flow in
 10 the event that, as the Court put it, "its reasoning no
 11 longer accords with reality along the
 12 Kishenganga/Neelum".
 13 This was perhaps a second limitation or exception
 14 identified by the Court to the otherwise res judicata
 15 effect of its awards. The first limitation or
 16 exception, as we saw before, prevented retroactive
 17 application, whether it's formally an exception to
 18 res judicata or actually part of the res judicata and
 19 a limitation on the general binding effect. That was
 20 the first exception or limitation: it would not be
 21 retroactive. And secondly, here, this is a more
 22 forward-looking limitation or exception, designed to
 23 allow for an amended application of the Treaty in the
 24 event of uncontrollable but significant changes in
 25 circumstances.

Page 162

15:35 1 here.
 2 In other words, certainly in this particular
 3 context, the Court said, "We think that there may be
 4 reasons why our award may need to be changed, and we're
 5 going to put a time limit on that". But is it also
 6 possible that there's a recognition here that
 7 res judicata should not apply in other circumstances,
 8 where the reasoning of the award does not accord with
 9 reality over time, including with respect possibly to
 10 climate change or other factors? Because if that's the
 11 case, it seems like a rather important exception that
 12 you're identifying with respect to res judicata.
 13 MR FIETTA: Yes. Well, I think my answer for now would be
 14 really to focus on what the Court says in this passage,
 15 which does go, to an extent, to the broader issues that
 16 you've raised pertinently in your question. And it's
 17 a point to which we can return, of course.
 18 But the Court, in that passage where it said that it
 19 "considers it important not to permit the doctrine of
 20 res judicata to extend ... [where] reasoning no longer
 21 accords with reality", that high threshold, it was
 22 explicitly against the context in the previous paragraph
 23 of such a change in circumstances whereby the reasoning
 24 no longer accords with reality "as a result of factors
 25 beyond the control of either Party, including climate

Page 164

15:37 1 change", which was certainly in the minds of the Court
 2 there, and had been mentioned in the context of minimum
 3 flow; not in the context, of course, of drawdown
 4 flushing and the other part of the decision.
 5 This was limited to the minimum flow, the 9 cusecs
 6 part of the decision, where the Court believed that that
 7 may need to be reviewed in future as a result of any
 8 dramatic changes in circumstances specific to that plant
 9 and that river. I don't think you can read this
 10 decision more broadly in connection with climate change
 11 being a potential basis to reopen res judicata
 12 generally. I think it was very specific to a specific
 13 situation addressed around this minimum flow issue, and
 14 for now I certainly would not read more into it.
 15 THE CHAIRMAN: I mean, it's certainly an interesting
 16 approach, in that one could imagine writing
 17 paragraphs 117 to 119 simply to say that, "For the next
 18 seven years, in the event that there are changes of some
 19 kind that relate to this issue, either party may return
 20 to the Court to revisit/reconsider this particular
 21 judgment", as opposed to saying, as it does here, that,
 22 "The doctrine of res judicata is somehow affected when
 23 there is a change in circumstances".
 24 I understand what you're saying, that you see it as
 25 limited in this particular context. But it arguably

Page 165

15:40 1 parties can reopen the decree in light of changed
 2 circumstances. Is there a similar principle in
 3 international law that would apply?
 4 MR FIETTA: No, I don't think there's a direct equivalent to
 5 that, and there's no equivalent tool or procedure
 6 provided for under the Treaty here. And that's,
 7 I think, partly why the Court felt it needed to make
 8 explicit provision along those lines in its final award.
 9 MR MINEAR: The language here is strikingly similar to
 10 equitable decrees that are entered in inter-state
 11 disputes in the United States, and that's why I asked
 12 the question. Thank you.
 13 MR FIETTA: It may be that Judge Schwebel, who was president
 14 of that Court, had those US rules in mind when writing
 15 this part of the award. But certainly that's not
 16 a canon of international law.
 17 MR MINEAR: Thank you.
 18 THE CHAIRMAN: Two smaller questions relating to Courts of
 19 Arbitration, before you move on to the Neutral Expert,
 20 if that's okay.
 21 One is: in Annexure G, paragraph 29, we've got the
 22 applicable law provision. It does refer to the
 23 possibility, when necessary, of applying treaties and
 24 applying customary international law. It does not then
 25 go on to refer to, for example, judicial decisions, as

Page 167

15:39 1 opens the door to a broader potential effect on
 2 res judicata.
 3 MR FIETTA: Well, I think our position is certainly that
 4 it would not open the door to a broader relevance or
 5 exception to res judicata based on climate change more
 6 broadly. I think this was designed to protect Pakistan,
 7 primarily, in the event that, as a result of
 8 a fundamental change on that specific river and the flow
 9 on the river, an ability to reconsider the decision on
 10 the minimum flow if these factors outside the control of
 11 either party should necessitate such a reconsideration.
 12 Of course, that has not happened. There has been no
 13 such dramatic change in circumstances beyond the control
 14 of either party.
 15 I certainly don't think -- and the Court was not
 16 here intending to say -- that climate change more
 17 broadly could be a basis to reopen hard and fast rules
 18 set under the Treaty, including as regards the design
 19 and operation of HEPs on the Western Rivers. And we saw
 20 elsewhere in the award, in connection with the concept
 21 of environmental flow, that the Court was very careful
 22 to indicate the limits of that principle in similar
 23 terms.
 24 MR MINEAR: In common law jurisdictions, it's commonplace,
 25 when an equitable decree is entered, to provide that the

Page 166

15:42 1 one might have expected, given Article 38 of the
 2 ICJ Statute. I'm wondering if we should draw any
 3 significance from that for the purposes that you were
 4 discussing.
 5 One thought, just while you're gathering your
 6 thoughts, is that the Treaty elsewhere, as you've
 7 already walked us through, addresses the final and
 8 binding nature of Court of Arbitration awards and
 9 Neutral Expert determinations. So perhaps that's where
 10 it's picked up. But I'm wondering whether you think its
 11 absence here, in paragraph 29, is of any significance.
 12 MR FIETTA: Well, I think, as you say, the final and binding
 13 nature of Court of Arbitration awards under the Treaty
 14 is dealt with elsewhere, and the limited final and
 15 binding nature of Neutral Expert decisions within their
 16 competence is dealt with elsewhere, so that issue did
 17 not need to be addressed here.
 18 As regards broader jurisprudence in international
 19 law, if you like, I think two points.
 20 I think it makes sense, given the specific nature of
 21 this Treaty -- almost a lex specialis around governing
 22 the Indus Waters -- that it should not explicitly
 23 indicate a role in the interpretation or application of
 24 this Treaty to broader international jurisprudence, as
 25 such, directly. But of course those decisions do come

Page 168

15:44 1 in in any event through the fact that customary
 2 international law itself is part of the applicable law
 3 here in certain situations, and of course customary
 4 international law itself will provide a gateway to the
 5 citation of international jurisprudence.
 6 Clearly paragraph 29 is very carefully drafted so as
 7 to limit aspects of the applicable law, and to focus on
 8 primarily the primary importance of the wording of the
 9 Treaty.
 10 THE CHAIRMAN: I had one other relatively small question.
 11 And I do think maybe we are close to the point of
 12 a coffee break, and if you want to look at this during
 13 the break, feel free to do so.
 14 But it's at your Memorial, paragraph 8.73, which is
 15 on page 239. I found that paragraph a little bit
 16 confusing. So if you could explain what is meant in due
 17 course, that would be helpful.
 18 It refers to the possibility of relitigating before
 19 a Neutral Expert a matter of Treaty interpretation that
 20 was made by a prior Court of Arbitration, and it seems
 21 to allow this when the matter before the Neutral Expert
 22 falls outside the dispute before the prior Court of
 23 Arbitration. But I don't see how that's relitigating
 24 a matter. That's where my confusion comes from. So
 25 perhaps you could look at that and let us know.

Page 169

15:46 1 In any event, I think we're close to a point where
 2 we should take a break. Sir Daniel?
 3 SIR DANIEL: Thank you, Mr Chairman.
 4 I had just a practical question. I notice -- and
 5 we'll have an opportunity to discuss this with
 6 Mr Fietta -- but he's got a fair way still to go, and
 7 from a position where we were feeling comfortable with
 8 time, I think we're now feeling a bit stressed with
 9 time. So I just have a question as to whether you would
 10 be content to shrink the coffee break just a little bit,
 11 as we were discussing just before lunch, and I will
 12 discuss with Mr Fietta whether he might be a little
 13 accelerated in respect of what he still has to cover.
 14 In saying this, I would like, though, to emphasise
 15 that we absolutely do not want to cut off any questions
 16 from the Court, because the compendium of questions that
 17 we are compiling will in fact inform our second-round
 18 submissions. But it may be that we will have a bit of
 19 a self-denying ordinance in actually giving answers, or
 20 answers of any length.
 21 I do want to make sure that Professor Webb has at
 22 least 75 minutes to cover the ground before 5.30.
 23 THE CHAIRMAN: Well, that's fine. Why don't we take just
 24 a 15-minute coffee break, come back roughly at the top
 25 of the hour, maybe two minutes afterwards, and then

Page 170

15:47 1 we'll resume and hopefully we'll make up time.
 2 SIR DANIEL: Thank you very much.
 3 (3.47 pm)
 4 (A short break)
 5 (4.02 pm)
 6 THE CHAIRMAN: Okay, I think we are reassembled. So,
 7 Mr Fietta, whenever you're ready, please proceed.
 8 MR FIETTA: Thank you, Mr Chairman, members of the Court.
 9 Just two quick points before I proceed, just
 10 cleaning up on issues arising before the break.
 11 Your question related to the separate reasoning
 12 wording in paragraph 23, alongside the reference to
 13 an award. Just for now, a reference, which will be
 14 picked up by my colleague Professor Tanzi later in the
 15 week. It's addressed at Memorial paragraph 13.14, which
 16 addresses that issue. We'll elaborate on that
 17 submission subsequently to pick up your question.
 18 And then your question just before the break in
 19 relation to: paragraph 8.73 of the Memorial perhaps
 20 could have been drafted a little more clearly. Just to
 21 be 100% clear on the intention of that paragraph.
 22 It wasn't intended to raise the possibility of
 23 relitigation of the same dispute. It is intended to
 24 cover the situation where a new difference arises
 25 between the parties that, as the paragraph later says,

Page 171

16:04 1 "falls strictly outside 'the dispute' addressed in [the]
 2 earlier Court of Arbitration [decision]". And therefore
 3 we would say that in that situation the concept of
 4 res judicata would not apply because it is a different
 5 dispute.
 6 (Slide 32) Turning then to Neutral Expert decisions.
 7 I can be much briefer, because we've addressed many of
 8 the principles and paragraphs of the Kishenganga award
 9 relevant to this issue.
 10 Decisions of Neutral Experts appointed under the
 11 Treaty are final and binding on the parties, on Courts
 12 of Arbitration and on other Neutral Experts, but only on
 13 matters falling within their more limited competence
 14 under the Treaty. And this is made clear by the Treaty
 15 itself at paragraphs 7 and 11 of Annexure F.
 16 (Slide 33) Paragraph 11 makes clear that:
 17 "[A] decision of a Neutral Expert on all matters
 18 within his competence shall be final and binding, in
 19 respect of the particular matter [concerned] ..."
 20 And specifically addressing all of the
 21 constituencies in your question, effectively, including
 22 a future Court of Arbitration.
 23 To the extent that the decision of the Neutral
 24 Expert therefore falls within his or her competence,
 25 it is res judicata in connection with the specific

Page 172

16:05 1 issues concerned at the specific plant concerned, and my
 2 previous submissions on res judicata would apply in that
 3 strict context.
 4 (Slide 34) Crucially, however, pursuant to
 5 Article IX of the Treaty, the competence of a Neutral
 6 Expert is limited to a closed list of differences of
 7 a technical or engineering nature falling within the
 8 list at subparagraphs 1 to 23 of paragraph 1 of Part 1
 9 of Annexure F. And this is commensurate with the fact,
 10 of course, that the Neutral Expert must be a "highly
 11 qualified engineer"; competent, therefore, to address
 12 only, but importantly, those technical issues that may
 13 arise under the 23 paragraphs at Annexure F.
 14 So unlike a Court of Arbitration, a Neutral Expert
 15 has no general interpretative competence under the
 16 Treaty and it's confined to these technical matters.
 17 A Neutral Expert cannot make general interpretative
 18 findings or systemic findings on the wording of the
 19 Treaty.
 20 (Slide 35) Paragraph 7 of Annexure F is also
 21 important because it confirms that the competence of
 22 a Neutral Expert extends to resolving disputes between
 23 the Commissioners as to whether any particular
 24 difference falls within Part 1 of Annexure F. So
 25 a Neutral Expert can render a binding decision with

Page 173

16:08 1 regards this issue of drawdown flushing in particular.
 2 The Court observed (PLA-3, paragraph 522):
 3 "It is not for the Court to apply 'best practices'
 4 in resolving this dispute ... any exercise of design
 5 involves consideration of a variety of factors -- not
 6 all of them technical."
 7 Then the Court goes on, in a passage we've read
 8 previously, to talk about, among other things, the
 9 regulatory constraints set by the Treaty for the design
 10 of Indian plants. And the Court concluded by saying
 11 that:
 12 "... the optimal design and operation of a [HEP] is
 13 that which can practically be achieved within
 14 constraints imposed by the Treaty."
 15 But, importantly, the interpretation adopted in the
 16 partial award did not apply to the Baglihar HEP, as
 17 we've seen. It was not retrospective, and Pakistan had
 18 never requested otherwise.
 19 (Slide 37) Paragraph 469 of the Kishenganga award is
 20 relevant in this context. The Court explained why its
 21 decision would have no effect to the Baglihar HEP. As
 22 the Court put it, Maître Lafitte's determination had
 23 "quite literally been realized in concrete at Baglihar".
 24 (Slide 38) But as the Kishenganga Court continued at
 25 paragraph 470:

Page 175

16:07 1 respect to his competence which has res judicata effect,
 2 save insofar -- another important proviso -- as that
 3 decision on competence itself takes him or her outside
 4 his or her competence and into the territory of
 5 paragraph 13 of Annexure F.
 6 A Neutral Expert does not, therefore, have
 7 compétence de la compétence in the same way as does
 8 a Court of Arbitration. It arises from the fact that
 9 questions of whether or not such decisions themselves
 10 fall within the competence of a Neutral Expert, or are
 11 otherwise ultra vires under the Treaty, are subject to
 12 the overriding jurisdiction of a Court of Arbitration.
 13 Consistent with Pakistan's position, at
 14 paragraph 316 of its Competence Award, this Court
 15 recognised that decisions of a Neutral Expert that are
 16 within his competence are final and binding with respect
 17 to the matter on which the decision was made.
 18 The only dispute to have been resolved under the
 19 Treaty to date by a Neutral Expert was the Baglihar
 20 decision, of course. As is well known, Pakistan
 21 profoundly disagreed with that determination.
 22 (Slide 36) The Kishenganga partial award
 23 subsequently agreed with Pakistan, and thus squarely
 24 rejected the Baglihar Neutral Expert's approach, in
 25 adopting its systemic interpretation of the Treaty as

Page 174

16:10 1 "The effect of a neutral expert's determination is
 2 restricted to ... elements of the design and operation
 3 of the specific [HEP] considered by that Expert."
 4 And again contrasting with the Baglihar decision,
 5 the Court said:
 6 "... the present decision, by contrast, is binding
 7 in respect of the general question presented in these
 8 proceedings."
 9 Paragraph 470 has summarised, in terms which are
 10 crystal-clear, the decisive and clear difference under
 11 the Treaty's dispute resolution architecture between the
 12 pervasive binding or otherwise controlling effect of
 13 Court of Arbitration decisions on systemic issues, at
 14 least, and the more limited binding effect of
 15 Neutral Expert decisions.
 16 Notably, in Kishenganga, even India stopped short of
 17 arguing that the Baglihar determination had any binding
 18 effect on the Court of Arbitration, just as it has
 19 stopped short of arguing that the decision has binding
 20 effect in negotiations, as we saw earlier.
 21 (Slide 39) In its rejoinder to the Court, India
 22 explicitly stated that it did not rely on Baglihar as
 23 constituting a binding precedent. We can see that in
 24 the first part of the highlighted passage here (P-227,
 25 paragraph 4.44). Rather, India's position was more

Page 176

16:11 1 nuanced, talking about Baglihar being authoritative, but
 2 not binding:
 3 "Such reliance is not sought as a binding
 4 precedent ..."
 5 So I think it is quite clear that India appreciates
 6 the limited effect -- res judicata effect, certainly --
 7 of Neutral Expert decisions.
 8 (Slide 40) And similarly, at 4.110 of its rejoinder
 9 in Kishenganga, India did not go further than saying
 10 that:
 11 "The decision of the Neutral Expert in the Baglihar
 12 case holding [drawdown flushing] a maintenance measure
 13 permitted by the Treaty, while not binding on this
 14 Court, is a sound precedent ..."
 15 So they were following the rationale, but they did
 16 not argue that it was binding in any sense on the Court.
 17 And in the Kishenganga hearing, India again referred
 18 to Baglihar not as binding but as a precedent, shying
 19 away from any legal submission that went beyond that.
 20 (Slide 41) As we've seen, the Court roundly rejected
 21 India's position at paragraph 470 of its award, saying
 22 that Baglihar did not have any general precedential
 23 value.
 24 So the sum effect of Kishenganga was then that the
 25 Court rejected the Baglihar Neutral Expert's conclusion

Page 177

16:15 1 parties with respect to those issues, or with respect to
 2 the Court and present proceedings before the Neutral
 3 Expert, and otherwise in connection with their
 4 competence.
 5 Unless there are any further questions, that will
 6 conclude my submission. Thank you.
 7 (4.15 pm)
 8 Questions from THE COURT
 9 THE CHAIRMAN: Just one question from me, Mr Fietta. I have
 10 not yet fully studied your matrix too; I look forward to
 11 doing so.
 12 But I'm wondering about the circumstance where
 13 a Neutral Expert decides that a certain matter is within
 14 his competence -- that is, falling within Annexure F,
 15 Part 1 -- and that decision is not challenged, and
 16 therefore doesn't go on to a Court of Arbitration. Is
 17 that decision on competence of the Neutral Expert
 18 thereafter binding on a Court of Arbitration?
 19 So let's say at some later point in time, one party
 20 or the other decides to say, "The Neutral Expert wasn't
 21 allowed to decide that matter". Is it open to a later
 22 Court of Arbitration to decide that it's not final and
 23 binding?
 24 MR FIETTA: Well, in that situation -- and that's reflected
 25 in the matrix in connection with decisions on competence

Page 179

16:13 1 that India was entitled under the Treaty to build a HEP
 2 on the Western Rivers with a deep orifice spillway for
 3 the purposes of drawdown flushing. The Court concluded
 4 that drawdown flushing was prohibited at Indian HEPs on
 5 the Western Rivers by paragraph 14 of Annexure D and
 6 paragraph 19 of Annexure E of the Treaty.
 7 This conclusion did not displace the Neutral
 8 Expert's determination of seven years earlier with
 9 respect to the Baglihar HEP, but it did apply both to
 10 the KHEP and to all future Indian HEPs on the
 11 Western Rivers.
 12 So at this point I can conclude my submission just
 13 by taking you back to the matrices which I gave you
 14 earlier. I won't spend any time on the substance of
 15 them. But the net effect, as you will have heard, of my
 16 submission, and of the colour-coding in the matrix to
 17 simplify things, is that Court of Arbitration decisions
 18 or awards within the scope of the disputes referred to
 19 them, which can be of many different types, are binding
 20 on all the constituent parties there: the parties,
 21 future courts, Neutral Experts and future Neutral
 22 Experts; whereas the position is much more restricted on
 23 the second matrix, in connection with the decisions of
 24 a Neutral Expert, which are binding only in respect of
 25 matters within their competence, binding only on the

Page 178

16:17 1 of a previous Neutral Expert in the present or future
 2 Courts of Arbitration -- the decision about competence
 3 under paragraph 7 would be binding, because it's within
 4 his competence, save in respect of a situation where
 5 there has been a challenge. But if there is no
 6 challenge and no contrary decision of the Courts of
 7 Arbitration, then there is no dilution of the
 8 res judicata effect.
 9 And of course this touches on the paragraph of
 10 Annexure F. It's paragraph ... I think I mentioned it.
 11 THE CHAIRMAN: Paragraph 13 is where it could be challenged
 12 as outside competence.
 13 MR FIETTA: Yes, thank you:
 14 "... if any [decision] (including a claim ...) which
 15 is not within the competence of a Neutral Expert should
 16 arise out of his decision, that question shall, if it
 17 cannot be resolved by agreement, be settled in
 18 accordance with the provisions ..."
 19 So it would need to be raised. There would be
 20 a dispute or a difference that would be raised about
 21 whether or not the decision was within the competence of
 22 the Neutral Expert. That would need to go through the
 23 procedures at Article IX that ultimately end up with the
 24 Court of Arbitration.
 25 THE CHAIRMAN: Right. And the question is --

Page 180

16:18 1 MR FIETTA: There is no limitation period to that.
 2 THE CHAIRMAN: And the question is: if it doesn't do that,
 3 and at some later point in time, before some other Court
 4 of Arbitration, there's a challenge made that that was
 5 outside the competence of the Neutral Expert, is that to
 6 be regarded as final and binding because it wasn't
 7 challenged at the time, or not?
 8 MR FIETTA: Yes.
 9 THE CHAIRMAN: So if that's true, then to the extent that
 10 Pakistan regards anything the Neutral Expert did in
 11 Baglihar as being outside the scope of his competence,
 12 given that that was not challenged at the time, why is
 13 that not regarded as final and binding by a subsequent
 14 Court of Arbitration such as this one?
 15 MR FIETTA: You may need to repeat the question. Pakistan
 16 does not, just to be clear, challenge the final and
 17 binding effect of the Baglihar determination in
 18 connection with the Baglihar plant relating to the
 19 specific issues raised in Baglihar. But did your
 20 question ...
 21 THE CHAIRMAN: Well, I thought I heard you say earlier in
 22 your presentation that the Neutral Expert did things
 23 outside the scope of his competence.
 24 MR FIETTA: Yes.
 25 THE CHAIRMAN: And to the extent that that's Pakistan's

Page 181

16:22 1 This bargain consists, on the one hand, that
 2 Pakistan "shall receive for unrestricted use all those
 3 waters" on the Western Rivers, as a result of which
 4 India must "let flow" those waters and "shall not permit
 5 any interference with [those] waters". That's on the
 6 one hand.
 7 The other side of the bargain is the tightly
 8 constrained exceptions, including the exception that the
 9 waters of the Western Rivers can be used for the
 10 generation of hydroelectric power in accordance with
 11 Annexure D.
 12 (Slide 2) I will be proceeding in four parts.
 13 First, looking at Article III and the rule there.
 14 Second, at the relationship between Article III and
 15 other provisions, going through hydroelectric power,
 16 other uses, and briefly on storage. Third, I'll look at
 17 the cooperation and reporting requirements that reflect
 18 and underpin this bargain, and there is a handout for
 19 you in that regard that I will refer to at that stage.
 20 And then finally, I will address question (b) from
 21 paragraph 35 of Procedural Order No. 6.
 22 (Slide 3) So I start with Article III of the Treaty,
 23 which guarantees Pakistan's exclusive use of the waters
 24 of the Western Rivers, subject to strict exceptions.
 25 I'm not going to read it out; I'm just going to

Page 183

16:19 1 position, is it not for this Court to look at that,
 2 because it wasn't challenged at the time?
 3 MR FIETTA: Well, he did that, but only in connection with
 4 his decision concerning the Baglihar plant. So those
 5 broader statements of Treaty interpretation, object and
 6 purpose, they are certainly not of any legal consequence
 7 in this proceeding because they were context to his
 8 specific decision in relation to the technical issues
 9 that he decided at the Baglihar plant.
 10 Pakistan is on record as having disagreed with those
 11 aspects, alongside a number of others, of his decision.
 12 But there is no need to re-examine them here because
 13 those paragraphs have no legal significance to this
 14 proceeding.
 15 THE CHAIRMAN: Okay. Thank you very much, Mr Fietta. So
 16 we appreciate your presentation, and I think we now have
 17 Professor Webb to take up the task of further educating
 18 the Court about the matters at hand. (Pause)
 19 Professor, please proceed.
 20 (4.22 pm)
 21 Submissions on the Western Rivers Run-of-River Hydro Bargain
 22 PROFESSOR WEBB: (Slide 1) Thank you, Mr Chairman,
 23 members of the Court. I'll be addressing you on the
 24 Western Rivers run-of-river hydro bargain which
 25 underpins the Treaty.

Page 182

16:24 1 highlight the terms that underpin this bargain.
 2 So in the first paragraph, the "unrestricted use"
 3 accorded to Pakistan, and the matching obligation of
 4 India to "let flow".
 5 In the second paragraph, again the obligation to
 6 "let flow", and the more precise obligation not to
 7 "permit ... interference" with those waters. And
 8 I'll come to the definition of that.
 9 In paragraph (3), again the reference to
 10 "unrestricted use" of the waters.
 11 And in paragraph (4), "Except as provided for in
 12 Annexures D and E", the prohibition on storage by India
 13 of any water on those Western Rivers.
 14 Mr Minear pointed out yesterday that "let flow" is
 15 an unusual form of words in treaty practice. And
 16 Pakistan, insofar as it's been able to determine looking
 17 at a database of 600 international water conventions,
 18 has found that there is no direct comparator to the
 19 Indus Waters "unrestricted use"/"let
 20 flow"/"non-interference" obligation; again reinforcing
 21 the very bespoke nature of this Treaty.
 22 The concept of "flow" itself is included in
 23 a handful of agreements, but with a very different
 24 emphasis and scope. And just to give you one example,
 25 the 1961 US-Canada Treaty relating to Cooperative

Page 184

16:25 1 Development of the Water Resources of the Columbia River
 2 Basin (PLA-100, Article II(1)) refers to Canada
 3 providing certain storage "usable for improving the flow
 4 of the Columbia River". So a very different use of
 5 "flow" there.
 6 (Slide 4) So four points are worth noting about the
 7 wording of paragraph (1) of Article III.
 8 The first is that "let flow" is the corollary
 9 obligation of Pakistan's right of "unrestricted use":
 10 they go together.
 11 "Let flow" is not framed in terms of an obligation
 12 of non-appropriation. So India can use the waters of
 13 the Western Rivers, so long as they are replaced in
 14 an equivalent amount.
 15 "Let flow" is a positive obligation: that means
 16 it is a starting point for analysing compliance, not
 17 an afterthought.
 18 And "let flow" is not limited in terms of the
 19 volume: it applies to all the relevant waters. So it
 20 wouldn't be permissible, for example, for India to argue
 21 that it only partially impeded the flow of the Western
 22 Rivers. "Let flow" is associated with "all the waters".
 23 And of course this is relevant to the Treaty bargain
 24 that we've set out, where India was allocated the waters
 25 of the Eastern Rivers for its use under the Treaty.

Page 185

16:28 1 each country."
 2 And the appendix to that letter noted that
 3 interference by hydroelectric work "is repugnant to the
 4 provisions of the Adjusted Bank Proposal and Pakistan
 5 cannot agree to any such works in areas under the
 6 control of India".
 7 So that was the position on 10 September 1957.
 8 As we heard from Ms Rees-Evans, Pakistan came under
 9 pressure from the World Bank and eventually made
 10 a concession. It accepted a narrow exception to its
 11 right of unrestricted use during August and
 12 September 1959.
 13 (Slide 6) So a provision for a carve-out for India's
 14 generation of hydroelectric power then appeared in
 15 the heads of agreement from 1959 (P-136), and the
 16 language was one of entitlement. You see that on the
 17 left-hand side of the slide. At that time India was
 18 being "entitled to generate hydro-electric power". But
 19 with the first drafts of the Treaty itself, it changed
 20 into an exception from an entitlement, and you see that
 21 in the document on the right (P-139).
 22 This shift from entitlement on the part of India to
 23 an exception that India has to come within is
 24 significant, because it makes "unrestricted use" and
 25 "let flow" the rule, and the generation of hydroelectric

Page 187

16:27 1 Article III(2) introduces the principle of
 2 non-interference with the waters of the Western Rivers,
 3 except for tight restrictions. And the parties
 4 understood at the time that this meant that India should
 5 not alter the flow, in quantity or timeliness, of the
 6 Western Rivers as they pass into Pakistan.
 7 Ms Rees-Evans has already taken you through the
 8 travaux; I am not going to go through them in detail.
 9 But I just want to highlight a handful of documents that
 10 really express the hydro bargain as it developed through
 11 the negotiations.
 12 (Slide 5) So the first is a letter from Pakistan's
 13 Minister of Industries of 10 September 1957 (P-420).
 14 So this is quite early in the process of negotiations
 15 and expresses Pakistan's position very clearly. And
 16 it says:
 17 "Being the lower riparian, Pakistan alone is
 18 vulnerable to interference by India. By introducing for
 19 the first time at this stage new uses on [the] Western
 20 Rivers ... [such as the] unrestricted right to develop
 21 hydro-electric power from those rivers, India has, while
 22 trying effectively to secure to herself the exclusive
 23 use and development of the Eastern Rivers, sought to
 24 deny the reciprocal independence to Pakistan which the
 25 Bank Proposal and the Aide Memoire promised to afford to

Page 186

16:30 1 power under certain conditions the exception.
 2 So I spoke yesterday about context in the role of
 3 treaty interpretation, and that involves looking at
 4 other provisions of the Treaty. And I turn, with that,
 5 to Article I(15) and the travaux behind that provision,
 6 which defines the obligation of non-interference.
 7 (Slide 7) So in the draft of December 1959 (P-139),
 8 it was quite a brief statement that:
 9 "The term 'interference with the waters' [is] any
 10 act of withdrawal ... or any man-made obstruction ...
 11 that causes a change in volume of the daily flow ..."
 12 In the final version of the Treaty, we have the
 13 emphasised language that makes very clear how strict
 14 this prohibition on interference is. It reads:
 15 "Provided, however, that an obstruction which
 16 involves only an insignificant and incidental change in
 17 the volume of the daily flow, for example, fluctuations
 18 due to an afflux caused by bridge piers or a temporary
 19 by-pass, etc., shall not be deemed to be an interference
 20 with the waters."
 21 So this language was inserted in response to
 22 discussions about: what did it mean to have a change in
 23 the volume of the daily flow? And the final version of
 24 the Treaty, in this subparagraph, gives a very clear
 25 answer: any practically measurable change in the flow

Page 188

16:31 1 caused by India that exceeds something "insignificant or
 2 incidental" is not permitted. And the examples given,
 3 such as water flowing around a bridge pier, show just
 4 how strict this definition is. This affirms the
 5 importance of the rule in Article III of the Treaty.
 6 (Slide 8) Coming now to the third paragraph of
 7 Article III, which provides that "Pakistan shall have
 8 the unrestricted use of all waters" and "India shall not
 9 make use of these waters". So this is again showing the
 10 underpinning of the hydro bargain, which is infused
 11 throughout this provision.
 12 Pakistan has a right to unrestricted use of all the
 13 waters, other than the Eastern Rivers; and on the other
 14 hand, India is prohibited from making use of these
 15 waters. And the same provision -- so it's not put
 16 separately; it's in the same provision, so it's very
 17 much tied to this balance -- says that there will be
 18 "discharge observation stations", emphasising that
 19 constant monitoring and cooperation is envisaged to make
 20 this balance stick.
 21 (Slide 9) Article III(4) deals with the principle of
 22 no storage by India, and that is subject to the
 23 provisions of Annexures D and E.
 24 As the Kishenganga Court held, this again reflects
 25 the bargain and it reflects the object and purpose of

Page 189

16:33 1 the Treaty. It stated (PLA-3, paragraph 504) that:
 2 "... one of the primary objectives of the Treaty is
 3 to limit the storage of water by India on the
 4 Western Rivers."
 5 The travaux préparatoires confirm the importance of
 6 the no-storage principle. I'm not going to go through
 7 them in detail; Ms Rees-Evans has done that. But just
 8 to highlight how this was very much in the minds of the
 9 drafters and how it was addressed.
 10 (Slide 10) So in August 1959 -- this is the document
 11 on the left-hand side of the screen (P-468) -- both
 12 parties' draft heads of agreement envisaged that India's
 13 hydroelectric use of the Western Rivers would be a type
 14 of "non-consumptive use", but India's draft also
 15 proposed that it be given a limited storage capacity for
 16 hydroelectric power plants. The President of Pakistan
 17 wrote on 21 August 1959 emphasising Pakistan's
 18 consistent position that it must be guaranteed the
 19 "total flow of the Western Rivers, excepting for
 20 insignificant uses in Jammu and Kashmir only".
 21 A new request by India was then made of "no limit to
 22 uses from Indus, Jhelum above lake, and Chenab RL 2000
 23 covering Jammu and Kashmir". This was in direct
 24 response to the strong position that Pakistan had put
 25 forward.

Page 190

16:34 1 The parties then engaged in intense negotiation
 2 through spring of 1960. This actually held up progress
 3 on the drafting of the annexures of the Treaty while
 4 they tried to resolve this issue. And again, under
 5 pressure from the World Bank, Pakistan made a
 6 concession to include the reference to Annexure D in the
 7 draft of June 1960, so allowing the production of
 8 hydroelectric power, but only with those criteria in
 9 Annexure D constraining that production.
 10 Yes, Mr Chairman.
 11 THE CHAIRMAN: This may fall outside the remit of your
 12 presentation. But because you mentioned the issue of
 13 storage as it might relate to Annexure E, are you able
 14 to say a few words about the relationship between the
 15 two annexures? In Annexure E, there are some specified
 16 limitations on storage. And it wasn't entirely clear to
 17 me to what extent that speaks as well to potential
 18 storage at hydroelectric plants that are governed by
 19 Annexure D.
 20 PROFESSOR WEBB: Right, right.
 21 THE CHAIRMAN: And if you're able to address that now, or
 22 someone in the course of the next day or two, that would
 23 be useful.
 24 PROFESSOR WEBB: Yes, I will be coming to it briefly. But
 25 just to give a direct answer now, this is part of the

Page 191

16:36 1 context of interpretation: that the unrestricted use,
 2 let flow, non-interference and no storage all come
 3 together in the hydro bargain.
 4 But having said that, Annexure E has different
 5 criteria to Annexure D. Unless there's an express
 6 cross-reference, you can't transpose them. And those
 7 specifications on storage in Annexure E would not be
 8 applicable to a run-of-river plant, as opposed to
 9 a storage work that is governed by Annexure E. What is
 10 important from this is how strict those conditions are
 11 even for a storage work, reflecting again how strict
 12 Annexure D criteria are as well.
 13 But we can certainly come back to that more
 14 specifically.
 15 THE CHAIRMAN: That's very helpful. Just if I understand
 16 it, the storage works regulated by Annexure E may well
 17 be associated with a hydroelectric plant governed by
 18 Annexure D.
 19 PROFESSOR WEBB: Yes, that's true.
 20 THE CHAIRMAN: But these are different storage requirements
 21 that we're talking about, in terms of what E addresses,
 22 and then what pondage and freeboard and whatnot relates
 23 to in Annexure D.
 24 PROFESSOR WEBB: Exactly. And Mr Minear pointed out,
 25 I think yesterday, the cross-reference in Annexure E to

Page 192

16:37 1 "Pondage", capital P, in Annexure D. So where that is
 2 expressly cross-referenced, then you would read them
 3 together. But otherwise, these are dealing with
 4 separate works; and where they do coincide, that's
 5 specifically dealt with in the Treaty.
 6 (Slide 11) So that brings me to the relationship
 7 between Article III and the provisions of the Treaty in
 8 other sections. And this brings me to the relationship
 9 between the rule and the exception. And you could
 10 combine these in one diagram. But just because we're
 11 not dealing with Annexure E as such in this dispute, you
 12 can see the difference there.
 13 So we have the unrestricted use, let flow,
 14 non-interference and no storage as the rule; and the
 15 exceptions set out in Article III and the paragraphs of
 16 Annexure D; the no storage rule which is subject to
 17 Annexures D and E.
 18 I want to come back here to the Treaty point and
 19 Sir Humphrey Waldoock, which Sir Daniel flagged this
 20 morning.
 21 Mr Chairman, yesterday you observed that the
 22 restrictive interpretation canon had been considered by
 23 the ILC and not expressly included in Articles 31 and 32
 24 of the Vienna Convention. And you suggested that India
 25 may prefer a competing canon of interpretation, also not

Page 193

16:39 1 expressly in Articles 31 or 32, that would interpret the
 2 exception in of itself, without regard to some idea that
 3 it needs to be narrowly construed. And I just want to
 4 set out Pakistan's position on that.
 5 First of all, there is evidence in the travaux of
 6 the Vienna Convention, and certainly in the
 7 jurisprudence of international courts since then, that
 8 there is a customary principle that exceptions to a rule
 9 are to be interpreted restrictively.
 10 But quite apart from that, and in any event, we do
 11 not need to rely on a canon of restrictive
 12 interpretation because, as Sir Daniel said this morning,
 13 in application of the general rule, Article 31, we reach
 14 a narrow interpretation of Annexure D. It is compelled
 15 by the object and purpose of the Treaty, by the context,
 16 by the obligation of good faith, by the ordinary meaning
 17 of the words and by the effet utile, which is linked to
 18 the object and purpose.
 19 And India's potential argument on interpretation,
 20 looking at the exception in and of itself, doesn't work,
 21 because the exception is written into the rule. It is
 22 not just in Annexure D: it is in Article III itself. So
 23 we cannot construe Article III without construing the
 24 exception, and we cannot construe Annexure D without
 25 construing the rule. It's not a self-standing

Page 194

16:40 1 provision.
 2 I now turn to five factors that reinforce this
 3 rule-exception relationship.
 4 (Slide 12) The first is just the text: the way that
 5 the exception is expressly addressed on the face of
 6 Article III.
 7 The second is that the exceptions are not only
 8 exceptions to India's let-flow obligation, but also to
 9 Pakistan's right of unrestricted use, and the injunction
 10 that India shall not permit any interference with the
 11 waters of the Western Rivers. "Interference with the
 12 waters of the Western Rivers" is a term of art.
 13 I've just shown you how strict it is: it basically just
 14 excludes water going around a bridge pier or a temporary
 15 bypass. So the "let-flow" obligation is broad. The
 16 non-interference obligation is clear and precise.
 17 The third point is that the hydroelectric power
 18 generation exception in Article III(2)(d) is expressly
 19 contingent on compliance with Annexure D. It doesn't
 20 say simply that India can use the waters of the Western
 21 Rivers for hydroelectric power generation; it says it
 22 can use the waters "as set out in Annexure D".
 23 So Annexure D is an inextricable part of
 24 hydroelectric power generation. And if India does not
 25 bring itself within the terms and conditions of

Page 195

16:42 1 Annexure D, then it cannot bring itself within the
 2 hydroelectric power exception in Article III. And this
 3 would be compatible with Sir Humphrey Waldoock's
 4 preference, which is that the basic rule of treaty
 5 interpretation is the primacy of the text (from his
 6 Third Report).
 7 The fourth factor is that the terms of
 8 Article III(4) are an injunction that is not located in
 9 paragraph (2) of Article III. It is instead set out in
 10 a self-standing clause that is subject to its own
 11 exception which I have already taken you to, "Except as
 12 provided in Annexures D and E". So these two rules and
 13 these two exceptions together complete the circle by
 14 conditioning any use and storage of water by India on
 15 the Western Rivers with complying with strict criteria
 16 set out in the Treaty.
 17 And fifth, as we will explain in the coming days,
 18 the terms of Annexure D itself heavily constrain India's
 19 right to the use of the waters for hydroelectric power
 20 generation. Paragraph 2(g) of Annexure D provides that
 21 a run-of-river plant is one "that develops power without
 22 Live Storage ... except for Pondage". And the criteria
 23 in paragraph 8 of Annexure D are those to which the
 24 design of any new run-of-river plant "shall conform";
 25 mandatory language. So the effect is again to reinforce

Page 196

16:43 1 this rule-exception relationship.
 2 I now turn to the relationship between Article III
 3 and the provisions on hydroelectric power.
 4 (Slide 12) Under the hydro bargain, India is
 5 entitled to generate hydroelectric power insofar as
 6 it does so within the constraints set out. So I'm not
 7 going to read this out, but you see that provision
 8 expressly there in (2)(d).
 9 Now, the chapeau of Article III(2) expressly
 10 restricts the use of waters, save for an exception for
 11 irrigation in Annexure C, to "the drainage basin" of the
 12 Western Rivers.
 13 Annexure D is divided into five parts. Two of them
 14 are relevant for our purposes, the present purposes:
 15 Part 1, defining key terms; and Part 3, on how new
 16 run-of-river plants are to be designed and operated.
 17 (Slide 13) So paragraph 1 of Annexure D again has
 18 this constraining language: it says that it is "subject
 19 to the provisions of [the] Annexure", the generation of
 20 the power, and "Provided that" certain criteria are met.
 21 So that wording of "Provided that" ensures that new
 22 hydroelectric plants that incorporate storage works are
 23 to be addressed under Annexure E, so that means that new
 24 run-of-river plants cannot be plants that incorporate
 25 storage works. And while run-of-river plants are

Page 197

16:45 1 permitted to store a limited volume of water as pondage,
 2 there's a restricted volume of live storage.
 3 (Slide 14) Paragraph 2(g) defines a run-of-river
 4 plant as one that:
 5 "... develops power without Live Storage as
 6 an integral part of the plant, except for Pondage and
 7 Surcharge Storage."
 8 And Annexure D then goes on to describe in detail
 9 those design requirements, and we will be going through
 10 them in detail over the next couple of days. I just
 11 want to, in advance of that, highlight a few concepts
 12 that we will be addressing in greater detail, and some
 13 of which reflect the special meaning that I mentioned
 14 yesterday that departs from the ordinary meaning in
 15 either dictionaries or engineering parlance.
 16 (Slide 15) So "Dead Storage" is defined in
 17 paragraph 2(a) of Annexure D as the water stored in the
 18 reservoir for non-operational purposes; and, as we've
 19 heard already, pursuant to paragraph 19 of Annexure E,
 20 and extended to Annexure D by paragraph 14, cannot be
 21 discharged for anything other than an unforeseen
 22 emergency.
 23 The "Dead Storage Level" sits below the operating
 24 pool and accounts for all the remaining water in the
 25 reservoir. This is a term with a special meaning, and

Page 198

16:47 1 different to how it would be used in ordinary
 2 engineering usage. It's been tailored to the Treaty.
 3 "Live Storage", pursuant to paragraph 2(b) of
 4 Annexure D, is the water in the reservoir above the dead
 5 storage level, used operationally.
 6 And "Pondage" we'll be spending a lot of time on
 7 on Friday. [It] is defined with a special meaning of:
 8 "... Live Storage of only sufficient magnitude to
 9 meet fluctuations in the discharge of the turbines
 10 arising from variations in the daily and ... weekly
 11 loads of the plant."
 12 And this in turn leads to the "Full Pondage Level",
 13 being the normal upper level of the reservoir
 14 corresponding to maximum pondage that has complied with
 15 paragraph 8(c).
 16 And above the operating pool we have "Surcharge
 17 Storage", which is "uncontrollable storage occupying
 18 space above the Full Pondage Level", usually from
 19 emergency flood conditions.
 20 (Slide 16) So when dealing with a new run-of-river
 21 plant, India is required to comply with the design
 22 criteria of paragraph 8, understanding these concepts
 23 and designing for these concepts as they are defined in
 24 the Treaty. And these are mandatory design criteria.
 25 I'm not going to go through them; we will be hearing

Page 199

16:48 1 a lot about them over the next two days.
 2 (Slide 17) But I would observe, from the hydro
 3 bargain point of view and from the point of view of the
 4 object and purpose of the Treaty, that these criteria
 5 are not value-neutral. They reflect the object and
 6 purpose of the Treaty. And Mr Fietta just showed you
 7 this paragraph in the previous presentation from the
 8 partial award (PLA-3, paragraph 522), where the Court
 9 made very clear that "the optimal design and operation
 10 of a hydro-electric plant" is defined as one that "can
 11 practically be achieved within the constraints imposed
 12 by the Treaty".
 13 (Slide 18) So coming back to these criteria and how
 14 they reflect the hydro bargain. Except for
 15 paragraph 8(g) at the end, on regulating basins, the
 16 point of each of these criteria is to limit India's
 17 control of water and storage of water on the Western
 18 Rivers; once again, being consistent with the object and
 19 purpose of the Treaty.
 20 (Slide 19) And the impact of these design criteria
 21 can be illustrated by the change in the Kishenganga
 22 plant and how, whether you're designing under Annexure D
 23 or E, different issues arise.
 24 So the Kishenganga plant was first conceived as
 25 a storage work under Annexure E in 1971. In the

Page 200

16:50 1 original design, it was to store water during the
 2 high-flow season in a 220-million-cubic-metre reservoir
 3 behind a 77-metre-high dam wall. And it was to be used
 4 for enhanced power generation during the winter using
 5 stored water, not running water.
 6 Following Pakistan's objections in the Commission,
 7 India redesigned the Kishenganga plant in 2006 with
 8 a 35.48-metre-high dam wall and reservoir of
 9 18.35 million cubic metres. But in India's own words,
 10 "the revised Run-of-River design is largely the same as
 11 the earlier design". That was noted in the partial
 12 award of the Kishenganga Court (PLA-3) at paragraph 236.
 13 Now, the numbers were much smaller. But as the Court
 14 explained, "the axis of the dam, the location and [the]
 15 layout of the project, [and] its installed capacity
 16 [and] diversion works" had not changed.
 17 And to be clear, Pakistan considers the design and
 18 operation of Kishenganga to be inconsistent with the
 19 Treaty, even moving it from a storage work to
 20 a run-of-river plant, and would say it's actually better
 21 characterised as a storage work. And as we well know,
 22 it has disputes with India as regards to pondage
 23 intakes, outlets and spillways of the Kishenganga plant.
 24 (Slide 20) So moving from paragraph 8 to
 25 paragraph 15, we come to operational restrictions. And

Page 201

16:51 1 paragraph 15 sets out the general rule for hydroelectric
 2 plant operation that is intended to maintain the
 3 consistency of the downstream flow.
 4 I won't read it out but just to point out that
 5 paragraphs (i) to (iii) of paragraph 15 provide a series
 6 of river-specific limitations, in addition to the
 7 chapeau condition about maintaining consistency of flow.
 8 So we have specific conditions for Chenab Main,
 9 different locations, and then on the Jhelum and the
 10 tributaries.
 11 Paragraph 15 also imposes additional storage
 12 limitations on India. India cannot, for example, use
 13 a hydroelectric plant reservoir to store 100% of the
 14 waters for a fortnight and then release it down in
 15 a flood, creating downstream hazards for Pakistan. So
 16 once again, these conditions, this consistency of flow
 17 and this absence of interruption, reinforce the rule
 18 underlying the hydro bargain.
 19 (Slide 21) And once again, from the perspective of
 20 the context of the Treaty, and looking at how the other
 21 provisions cast light on paragraph 8, we see that the
 22 other exceptions in Article III also reflect this rule
 23 and exception, and this control over what India is able
 24 to do.
 25 So Article III(2)(a) permits "Domestic Use", which

Page 202

16:53 1 you see defined in Article I(10) at the bottom of the
 2 screen. Now, the first two domestic uses are relatively
 3 non-invasive: drinking, washing, sanitation, and
 4 household and municipal purposes. The third so-called
 5 domestic use, of "industrial purposes", could be more
 6 significant, because it could require significant
 7 offtake in some industries such as mining and smelting.
 8 (Slide 22) But that offtake is limited by
 9 Article IV(12), which provides limits on "The use of
 10 water for industrial purposes". So we have the
 11 narrowing down, through each provision, of what India is
 12 able to do with these waters.
 13 And this is interesting from the perspective of
 14 changing times, because this provision protects Pakistan
 15 from increasing industrial demands by India in the years
 16 following the Treaty's conclusion. The permitted
 17 consumption of water for an industrial process is
 18 limited to the quantum of use in 1960, ensuring that
 19 India cannot take advantage of developments that require
 20 more water, although it could take advantage of
 21 technology or new knowledge that require less water.
 22 In the case of an unforeseen but later developed
 23 industrial process, India can only use it to extract
 24 water from the Western Rivers to the extent that such
 25 a process does not have a substantially adverse effect

Page 203

16:55 1 on Pakistan. And under the second clause of
 2 subparagraph 13, India is entitled to extract water from
 3 the Western Rivers for use in an industrial process, but
 4 it is obliged to use "best endeavours", as you see
 5 there, "to return to the same river ... all water
 6 withdrawn therefrom".
 7 (Slide 23) Article III(2)(b) permits
 8 "Non-Consumptive Use", and that is defined in
 9 Article I(11). India can only rely on this exception to
 10 the extent that the use in question is for a relevant
 11 purpose, which are listed there. And it has to ensure
 12 that any water removed from the watercourse, beyond
 13 a de minimis amount, is returned to it; again,
 14 consistent with the let-flow obligation.
 15 You will note in Article I(11), and relevant
 16 discussions that we've been having over the last couple
 17 of days, that one "Non-Consumptive Use" by India is for
 18 the purpose of "flood protection or flood control"; it's
 19 in the second line of that provision.
 20 But again, that is limited under the Treaty, because
 21 in Article IV(2) it provides that:
 22 "In executing any scheme of flood protection or
 23 flood control each Party will avoid, as far as
 24 practicable, any material damage to the other Party, and
 25 any such scheme carried out by India on the Western

Page 204

16:56 1 Rivers shall not involve any use of water or any storage
 2 in addition to that provided [by] Article III."
 3 So that reference to "flood protection or flood
 4 control" in Article I(11) is not a licence for
 5 a so-called emergency use of water.
 6 (Slide 24) Finally, Article III(2)(c) and
 7 Article I(9) deal with agricultural use. There are ten
 8 paragraphs in Annexure C setting strict limits on
 9 India's irrigation from the Western Rivers in terms of
 10 the amount of water and the land area that can be
 11 irrigated.
 12 (Slide 25) So I now turn to storage, and Annexure E,
 13 again for context. This is not part of the current
 14 dispute, but it informs the hydro bargain.
 15 So as you see in Article III(4), "India shall not
 16 store any water ... or construct ... storage works",
 17 "Except as provided in Annexures D and E". The
 18 exception is built into the primary provision. We can't
 19 separate them and read them in a different way.
 20 (Slide 26) Under the Treaty, the capacity of India
 21 to construct any storage work is severely limited by
 22 Annexure E, and that starts with the definition of
 23 a "Storage Work":
 24 "... a work constructed for the purpose of
 25 impounding the waters of a stream ..."

Page 205

16:59 1 not be in this table. But can I come back to you on
 2 that?
 3 MR MINEAR: Sure, that would be fine. Thank you.
 4 PROFESSOR WEBB: And I should emphasise that whether it was
 5 a storage work or a run-of-river plant, Pakistan's
 6 position is it did not comply with the Treaty.
 7 MR MINEAR: Thank you.
 8 PROFESSOR WEBB: (Slide 28) So paragraph 11 has the detailed
 9 design criteria for storage works, not run-of-river
 10 works. And I'm not going to go through them, but what
 11 I will refer to is what the Kishenganga Court said.
 12 (Slide 29) And this runs through the theme of both
 13 what the Kishenganga Court said (paragraph 506) and what
 14 the Treaty requires, which is that:
 15 "... the Treaty doesn't [just] restrict the Parties
 16 from taking certain actions ..."
 17 It doesn't just prohibit the use of storage on
 18 certain rivers:
 19 "... but [it] constrains their entitlement to
 20 construct works that would enable such action to be
 21 taken."
 22 So it's not that the act has yet taken place; it's
 23 that even the means to undertake that act are
 24 constrained, and sometimes prohibited.
 25 (Slide 30) So the hydro bargain also relies not just

Page 207

16:58 1 (Slide 27) And I don't know if this is what you were
 2 referring to earlier, Mr Chairman. Paragraph 7 of
 3 Annexure E sets out the "aggregate storage capacity" of
 4 reservoirs constructed by India, and these are very
 5 small amounts.
 6 MR MINEAR: Professor Webb?
 7 PROFESSOR WEBB: Yes, Mr Minear.
 8 MR MINEAR: Excuse me, Professor Webb. Earlier, on
 9 slide 19, you indicated that Kishenganga was initially
 10 planned as a storage work.
 11 PROFESSOR WEBB: Yes.
 12 MR MINEAR: And it is on the Jhelum River; is that right?
 13 PROFESSOR WEBB: Yes.
 14 MR MINEAR: What confuses me is on the paragraph 7(c) --
 15 PROFESSOR WEBB: Apologies, it's on the Neelum.
 16 MR MINEAR: Oh, it's on the Neelum.
 17 PROFESSOR WEBB: Before it joins the Jhelum.
 18 MR MINEAR: The Neelum, yes.
 19 Well, is it subject to the power storage capacity
 20 limitation set forth in paragraph 7? If it's on the
 21 Jhelum, it says "Nil", "Power Storage Capacity".
 22 I don't understand how the power storage capacity
 23 limitations would allow that at Kishenganga.
 24 PROFESSOR WEBB: Yes. I will have to come back to you. But
 25 since the Neelum isn't mentioned there expressly, we may

Page 206

17:00 1 on this rule-exception relationship, but on cooperation
 2 and reporting requirements. And this takes us back to
 3 the preamble of the Treaty that refers to the
 4 "cooperative spirit" that is expected of the parties.
 5 Now, you have already heard on Monday about how
 6 these very detailed cooperation, consultation and
 7 information-sharing requirements operate -- or perhaps
 8 do not operate -- in practice from Pakistan's
 9 Commissioner for Indus Waters. And I have provided
 10 a handout -- it's more for your reference; I won't be
 11 going through it -- that provides an overview of each
 12 party's rights and obligations under the Treaty. We
 13 have Pakistan's rights; Pakistan is also subject to
 14 obligations. We have India's rights, and India is also
 15 subject to obligations.
 16 You will notice the difference in the detail and
 17 length of each of those categories. But what is
 18 important is: there is no blank column there. The
 19 parties are inextricably linked in how they are meant to
 20 be cooperating and sharing information throughout the
 21 design and operation and construction process.
 22 So Article VI(2) provides that either party may
 23 request the supply of data relating to the hydrology of
 24 the rivers. Article VII, on "Future co-operation",
 25 imposes that they have to cooperate by mutual agreement.

Page 208

17:02 1 (Slide 31) And VII(2), on the screen, provides that
 2 if either party planned to construct any engineering
 3 work that would "cause interference with the waters of
 4 the Rivers", that would affect the other party
 5 "materially", it is obliged to notify the other party of
 6 its plans. And the party planning the work shall, if
 7 requested, supply data if the work would cause
 8 interference with the waters, even if it did not
 9 consider that the other party will be materially
 10 affected.
 11 So this provision reflects the importance of the
 12 obligation of non-interference. Even if a party does
 13 not think there will be a material effect on the other,
 14 there is still an obligation to notify and to start
 15 engaging in that process of consultation.
 16 (Slide 32) Now, as we know, the most important site
 17 for cooperation under the Treaty is the Permanent Indus
 18 Commission. This is provided in Article VIII. And it
 19 is expressed there in paragraph (4) that the purpose and
 20 functions of the Commission are to maintain and
 21 establish these "co-operative arrangements" and "promote
 22 co-operation" on an ongoing basis.
 23 (Slide 33) And under paragraph 9 of Annexure D,
 24 which was also a provision that Pakistan's Commissioner
 25 took you to, India shall communicate in writing, at

Page 209

17:05 1 intended, cooperation between the parties on
 2 information-sharing is required from the outset and at
 3 each stage of design, construction and operation. And
 4 if these work as they were intended to work -- and as
 5 we heard from Pakistan's Commissioner, that is not the
 6 case -- it is supposed to permit the Commissioner to
 7 supervise Indian hydroelectric power plant construction
 8 and operation so that any issues can be identified early
 9 and resolved in accordance with Article IX.
 10 The Kishenganga Court took note of this (PLA-3,
 11 paragraphs 443 to 444), saying that:
 12 "... the Treaty prescribes a formal procedure
 13 designed to bring a measure of order and certainty in
 14 the resolution of competing claims, and to questions of
 15 propriety of Plant design, before construction
 16 commences."
 17 India's compliance with the unrestricted use, let
 18 flow, non-interference and no-storage obligation is not
 19 presumed by the Treaty. It is a system of "trust, but
 20 verify".
 21 (Slide 35) I now come to the question of the Court
 22 in paragraph 35(b) of Procedural Order No. 6, which is:
 23 "To what extent can non-Treaty-based design and
 24 operational practices be taken into account for purposes
 25 of interpreting the technical requirements set out in

Page 211

17:04 1 least six months in advance of the beginning of the
 2 construction, very defined information.
 3 So as part of the hydro bargain -- stepping back
 4 from the detail of these cooperation and reporting
 5 requirements -- India's design, construction and
 6 operation are subject to constant monitoring for
 7 compliance with the Treaty.
 8 It has to measure a variety of inputs daily and
 9 provide the data to Pakistan monthly, or daily if
 10 requested. It must inform Pakistan of any planned works
 11 likely to affect Pakistan's rights and interests, and
 12 provide it with information on them. It has a positive
 13 obligation to cooperate with Pakistan on river
 14 development and to promote such cooperation through the
 15 Commission. And India must also give Pakistan's
 16 Commissioner timely access to any facility it builds on
 17 the Western Rivers on demand, so that compliance can be
 18 assessed.
 19 (Slide 34) The implications of gathering all of this
 20 data and information are set out in paragraphs 10, 11
 21 and 12 of Annexure D, which address the action to be
 22 taken if a question arises as to whether a design is
 23 compliant, and which confirm the ongoing nature of the
 24 obligation of cooperation.
 25 So for the provisions of Annexure D to work as

Page 210

17:07 1 Annexure D, paragraph 8?"
 2 Pakistan's position is that non-Treaty-based design
 3 and operational practices can only be taken into account
 4 to the extent that such practices are consistent with
 5 the framework and the object and purpose of the Treaty.
 6 This gives India a degree of flexibility. The
 7 Treaty does not prescribe the materials with which the
 8 spillway gates or the turbines or other components must
 9 be constructed. The Treaty does not require that
 10 a hydroelectric plant use a desander, or prohibit the
 11 use of a desander. The Treaty does not fix the minimum
 12 size of outlets by reference to the technological
 13 capability of 1960, and it doesn't define what is
 14 necessary with respect to sediment control or conditions
 15 at site by reference to technology at the time the
 16 Treaty was concluded.
 17 Non-Treaty-based design and operational practices
 18 can be taken into account, including through -- as we
 19 will show in the coming days -- the language of
 20 paragraphs 8(d), (e) and (f) of Annexure D. But India
 21 cannot appeal to extraneous sources, or to so-called
 22 "best practice", without bringing it within those
 23 constraints.
 24 I want to recall pertinent points made by Dr Morris
 25 this morning to link the engineering insights with the

Page 212

17:08 1 legal framework here.
 2 As Dr Morris said, climate change can be taken into
 3 account. He explained that engineers design for high,
 4 not average, sediment loads. So if climate change will
 5 affect the amount of sediment, then you're already
 6 designing for that high load.
 7 He also said there's always innovations in
 8 hydropower engineering, including sediment management,
 9 such as turbine coatings. Such innovations are entirely
 10 compatible with the Treaty framework, and indeed they
 11 maybe be required by the Treaty framework, through the
 12 reference, for example, to "sound and economical
 13 design".
 14 He also observed that every project has its own
 15 little problem, or big problem: physical factors,
 16 geological factors, seismic factors and regulatory
 17 limitations, quite apart from the Treaty. But as he
 18 said, engineers can put their minds to it and the
 19 solutions will come up, whether it's a technology,
 20 a technique, a change of design or a change of site.
 21 As we stated in the Memorial, the correct approach
 22 to technological advancements or so-called "best
 23 practices" can be seen in the assessment of two issues
 24 by the Kishenganga Court. And I just want to go through
 25 them briefly to show how that Court took into account

Page 213

17:11 1 dam site at Gurez to the Line of Control" and to
 2 "incorporate a sufficient range of minimum flows so as
 3 to give the Court a full picture of the sensitivity of
 4 the river system".
 5 So underlying the Court's approach was its
 6 appreciation that the Treaty required India to operate
 7 Kishenganga to preserve the downstream flows. And that
 8 was informed by the requirement that states "take
 9 environmental protection into consideration when
 10 planning and developing projects that may cause injury
 11 to a bordering State".
 12 The Kishenganga Court wasn't stuck in 1960. It drew
 13 upon the International Court of Justice's analysis in
 14 the 2010 Pulp Mills judgment, and it emphasised (PLA-3,
 15 paragraph 450) that an EIA has to be undertaken:
 16 "... where there is a risk that the proposed
 17 industrial activity may have a significant adverse
 18 impact in a transboundary context, in particular, on
 19 shared resources."
 20 It also referred to the 2007 Iron Rhine arbitration,
 21 and spoke about the duty to mitigate significant
 22 environmental harm "when pursuing large-scale
 23 construction activities".
 24 So it didn't refer to best practices as such, and
 25 certainly not in the way that Indian invoked them. But

Page 215

17:10 1 developments and changing conditions, but without
 2 defaulting to a so-called "best practice" outside of the
 3 Treaty.
 4 (Slide 36) So the first was the role and scope of
 5 environmental impact assessments that India had to
 6 conduct to evaluate downstream effects from Kishenganga.
 7 Now, Pakistan's argument was that India's EIA was
 8 inadequate because the most important area -- that was
 9 "the area below the dam site" -- was not part of the
 10 EIA. So that was the scope.
 11 India countered that argument by invoking best
 12 practices, saying best practices only required that the
 13 EIA "be in writing", that it "be conducted sufficiently
 14 early on to be taken into account in decision-making",
 15 that it "include an opportunity for public comment", and
 16 that it "be comprehensive". And it tried to use this
 17 invocation of best practices to avoid defining the scope
 18 of its EIA.
 19 The Court, faced with these competing arguments,
 20 concluded that the evidence did "not provide an adequate
 21 basis" for the determination of the "maintenance of
 22 minimum flow downstream of the KHEP". It requested
 23 India to provide "further data concerning the impacts of
 24 a range of minimum flows to be discharged" at
 25 Kishenganga, including "environmental concerns from the

Page 214

17:13 1 it did rely on current and promising practices and
 2 decisions regarding EIAs that informed what the parties
 3 were required to do under the Treaty.
 4 The second issue in which this argument about best
 5 practices came up was drawdown flushing.
 6 India contended that drawdown flushing was one of
 7 the most effective techniques for maintaining the
 8 sustainability of reservoirs, and it cited practices in
 9 India, Switzerland, Austria, China, New Zealand and
 10 Venezuela. Pakistan responded that sediment sluicing
 11 offered a "feasible alternative" that respected the
 12 Treaty's framework.
 13 And as we know, the Court accepted Pakistan's
 14 argument, noting that "it is not for the Court to apply
 15 'best practices'" -- and I note that the Court put "best
 16 practices" in quotation marks; it was not resistant to
 17 a real best practice -- and that "the Treaty restraints
 18 on the construction and operation by India of
 19 reservoirs" are "a regulatory factor" in plant design,
 20 such that the Treaty prohibited drawdown flushing
 21 (PLA-3, paragraph 522).
 22 So the Court again did not accept the mere
 23 invocation of best practice to circumvent the Treaty
 24 requirements. But it was still very much open to
 25 engineering practices and innovations that are within

Page 216

17:14 1 the Treaty framework.
 2 In its approach to the interpretation of the Treaty,
 3 and the hydro bargain in particular, India tends to turn
 4 Article III on its head. It tends to take a narrow
 5 approach to the rule in Article III and an expansive
 6 approach to the exceptions also within Article III and
 7 as set out in Annexure D.
 8 India is motivated by its plan to "harness[] the
 9 significant hydro-electric potential available on the
 10 Western Rivers", as it has stated. I'm citing its
 11 Rejoinder in the Kishenganga arbitration, which is our
 12 Exhibit P-0227, at paragraph 4.97.
 13 And to this end, motivated by desire, India tries to
 14 characterise the object and purpose of the Treaty as the
 15 utilisation of waters, as I showed you yesterday.
 16 It only reads the first part of the preamble, and it
 17 overlooks the second part of the preamble, speaking of
 18 the:
 19 "... fixing and delimiting, in a spirit of goodwill
 20 and friendship, the rights and obligations of each in
 21 relation to the other concerning the use of these
 22 waters."
 23 In Ms Rees-Evans's exchange with Mr Minear
 24 yesterday, she confirmed that the Treaty does not limit
 25 the number of plants or the amount of power that India

Page 217

17:16 1 can generate on the Western Rivers. But a limit is
 2 there because it comes in through the criteria in
 3 paragraph 8 of Annexure D.
 4 India has interpreted each requirement in Annexure D
 5 so as to maximise its ability to control and manipulate
 6 the waters through the design and operation of
 7 hydroelectric plants. And as we've heard already, the
 8 Kishenganga plant and the Ratle plant are just examples
 9 of the standard Indian HEP design with common features
 10 that is being replicated in dozens of plants.
 11 India purports to adopt a "state-of-the-art"
 12 approach in order to circumvent the design and
 13 operational restrictions in Annexure D. But in reality,
 14 its designs are not state of the art, including their
 15 sole focus on empty flushing, as Dr Morris has
 16 explained, while also being in violation of the Treaty.
 17 (Slide 37) So I come back to the rule and the
 18 exception. The correct interpretative approach is to
 19 treat Article III as the rule, and to restrictively
 20 interpret, according to the ordinary meaning and the
 21 object and purpose, the exceptions in Article III(2) and
 22 Annexure D.
 23 This reflects the bargain at the heart of the
 24 Treaty. This approach requires that any best practices
 25 are adopted within the framework of the Treaty, and in

Page 218

17:17 1 a manner consistent with its object and purpose. As
 2 Dr Morris said, the Treaty is focused on sustaining the
 3 hydrology coming in to Pakistan. That is its object.
 4 The peace treaty and hydro bargains that were struck
 5 after years of negotiation, and with the assistance of
 6 the World Bank, was not an agreement for a fixed period.
 7 It wasn't an agreement that allowed for unilateral
 8 revision, or for reassessment through a continuously
 9 available process. It was meant to be stable and
 10 secure, and underpinned by cooperation and goodwill.
 11 That concludes my submissions. I'm very happy to
 12 take any questions, or we might have an early night.
 13 THE CHAIRMAN: Mr Minear?
 14 (5.18 pm)
 15 Questions from THE COURT
 16 MR MINEAR: Thank you, Professor Webb.
 17 I want to return to my question earlier about
 18 Annexure E, paragraph 7, and whether Kishenganga would
 19 comply with that. I think I've answered that question
 20 to my own satisfaction myself. I briefly said: the
 21 Neelum is a tributary of the Jhelum, and so therefore
 22 it would fall within 7(b). If I'm mistaken about that,
 23 please inform me later.
 24 PROFESSOR WEBB: I will.
 25 MR MINEAR: But I'd like to relieve you of the work of

Page 219

17:18 1 trying to correct --
 2 PROFESSOR WEBB: Thank you for the steer.
 3 THE CHAIRMAN: Professor Buytaert?
 4 PROFESSOR BUYTAERT: Thank you.
 5 I'm afraid I will bring you back to the table that
 6 you showed on your slide 27 about Annexure E. I know
 7 you've answered a previous question to the Chairman
 8 about this, but it wasn't entirely clear to me.
 9 In the second column here, so the "power storage
 10 capacity", I think you mentioned that Annexure E would
 11 not be applicable to run-of-river hydroelectric plants.
 12 So I wonder then: what kind of power production does the
 13 second column here refer to?
 14 PROFESSOR WEBB: I think that is power production from
 15 a storage work. But can I come back to you to clarify
 16 that?
 17 PROFESSOR BUYTAERT: Yes, I think if that's your answer, my
 18 follow-up question would be: what kind of power storage
 19 work is permitted under the Treaty?
 20 PROFESSOR WEBB: I will come back to you on that as well.
 21 Thank you.
 22 PROFESSOR BUYTAERT: Thank you.
 23 THE CHAIRMAN: So I just have one question, and then we'll
 24 let you and everyone go.
 25 I was particularly interested in the last part of

Page 220

17:20 1 your presentation, where you were answering that
 2 question that we had in paragraph 35(b). One could
 3 focus in on that particular question, which is about
 4 practices. But I'm wondering if one can look at this
 5 a little bit more holistically, as to where in the
 6 overall scheme of sources of law, or practices, one
 7 might see a progression of reasoning that should take
 8 place in any given instance.
 9 So let me read out to you what I discerned from your
 10 Memorial. And I don't expect you to answer this now,
 11 but it may be something worth pondering overnight and in
 12 the days to come. It seems to me that maybe Pakistan is
 13 advancing the following five steps as the sequence for
 14 applying sources of law or practices.
 15 First, the Treaty's specific requirements in all
 16 instances must be observed.
 17 PROFESSOR WEBB: Yes.
 18 THE CHAIRMAN: So, for example, don't use best practices to
 19 negate a specific Treaty requirement, such as perhaps on
 20 drawdown flushing.
 21 Second, those Treaty requirements sometimes allow
 22 for construction of a hydroelectric plant on the Western
 23 Rivers by India with reference to design or customary or
 24 accepted practices; and I know we'll be talking about
 25 that tomorrow. But this will often depend on

Page 221

17:22 1 a plant-by-plant analysis, such as the materials you
 2 would use to construct a spillway gate, or something
 3 like that.
 4 Third, it's possible for Treaty rights and
 5 obligations to be informed by, but not negated by,
 6 customary international law. So an example of that
 7 would be the Kishenganga use of international
 8 environmental law, as you just discussed to us.
 9 Fourth, on an issue not regulated by the Treaty, the
 10 parties are still bound by other treaties to which they
 11 are a party and customary international law. I think
 12 that probably then falls to a large extent outside the
 13 scope of the Treaty.
 14 And then fifth, on issues not regulated by any
 15 treaty or customary international law, the parties have
 16 discretion in the design and operation of the
 17 hydroelectric plants.
 18 This is my attempt to pull together into one place
 19 the propositions that were advanced in the Memorial.
 20 I may have got them right, I may have got them wrong.
 21 But I'd be interested in hearing from Pakistan at some
 22 point a gathering-together of these various sources in
 23 a way that might allow for a progression of analytical
 24 reasoning.
 25 PROFESSOR WEBB: Yes, thank you. That's very helpful, and

Page 222

17:23 1 we will study the transcript closely. I just give two
 2 reactions now.
 3 On your third point, that Treaty rights and
 4 obligations are informed by customary international law
 5 but not negated by it, I would add in there the
 6 necessity criterion from paragraph 29, Annexure G. So
 7 it's not just a test of: this doesn't negate what the
 8 Treaty says. To enter that gateway of customary
 9 international law or other conventional law, it has to
 10 be necessary.
 11 And on your fifth point, that there's discretion in
 12 design and operation if it's not issues falling within
 13 treaty or customary international law, I would add: the
 14 spirit of the Treaty, and also the role of the
 15 Commission, even in that instance, that there be
 16 data-sharing, consultation, visits and so on.
 17 THE CHAIRMAN: Very good. In that case, there are perhaps
 18 ways you'd want to massage the scheme I presented to
 19 you, and that's precisely why I put it to you not as
 20 an immediate response but a response in due course.
 21 PROFESSOR WEBB: Yes, and we will reflect on that,
 22 thank you.
 23 THE CHAIRMAN: I think we don't have any further questions
 24 for you. But thank you, Professor Webb. Your
 25 presentation was very helpful.

Page 223

17:25 1 I'll turn to Sir Daniel. I think we are probably
 2 done for the day, and relatively caught up. So unless
 3 there's other business, we will end the day and resume
 4 tomorrow morning.
 5 SIR DANIEL: Thank you, Mr Chairman. I think that's
 6 absolutely right, and I'm grateful for your indulgence
 7 over the coffee break. I hope that there was no
 8 self-denying ordinance on the part of the members of the
 9 Court in terms of asking questions, but no doubt
 10 otherwise we will get them in a flood on Saturday. And
 11 we are caught up in terms of timing, so we will start
 12 again tomorrow, and we are almost within sight of the
 13 pinnacle.
 14 THE CHAIRMAN: Excellent. We'll see you at 9.30 then.
 15 SIR DANIEL: Thank you.
 16 (5.26 pm)
 17 (The hearing adjourned until 9.30 am the following day)
 18
 19
 20
 21
 22
 23
 24
 25

Page 224

<p style="text-align: center;">A</p> <p>ABDULLAH 2:12</p> <p>ability 71:8 78:13,13 78:14,18,23 85:16 95:10,11 99:16 100:10 104:9 142:22 154:20 166:9 218:5</p> <p>able 16:2 33:23 42:24 46:11 50:10 57:17 59:25 60:13 62:23 71:10 75:14 78:17 82:17 83:22 95:23 96:10 98:6 101:11 107:6 110:24 132:25 184:16 191:13,21 202:23 203:12</p> <p>above 190:22 199:4,16 199:18</p> <p>abrasion 37:9</p> <p>abrupt 96:17 99:5</p> <p>abruptly 97:10</p> <p>absence 168:11 202:17</p> <p>absolutely 170:15 224:6</p> <p>accelerated 14:25 170:13</p> <p>accelerates 14:8 64:19</p> <p>accept 216:22</p> <p>accepted 106:17 129:14 187:10 216:13 221:24</p> <p>access 62:1 210:16</p> <p>accompanied 141:13 143:18 145:8</p> <p>accord 164:8</p> <p>accordance 140:11 144:2 146:1 159:6 180:18 183:10 211:9</p> <p>accorded 5:18 151:4 184:3</p> <p>according 149:7 218:20</p> <p>accordingly 120:24</p> <p>accords 162:11 163:6 164:21,24</p> <p>account 46:23 68:1 136:11 211:24 212:3,18 213:3,25 214:14</p> <p>accounts 198:24</p> <p>accumulate 28:16,18 48:1 77:12</p> <p>accumulated 20:16 75:16</p> <p>accumulating 28:15 59:16</p> <p>accumulation 152:14</p> <p>accustomed 51:4</p> <p>achieve 14:14 36:10 72:3</p> <p>achieved 175:13 200:11</p> <p>acknowledge 155:2</p> <p>acknowledged 137:9</p>	<p>142:9 151:1 154:9 159:21</p> <p>acknowledgement 155:5</p> <p>acknowledges 10:1</p> <p>across 9:18 49:12 79:5 97:18 138:12 156:4</p> <p>act 188:10 207:22,23</p> <p>action 20:1 207:20 210:21</p> <p>actions 45:10 207:16</p> <p>active 110:19</p> <p>activities 41:2 215:23</p> <p>activity 15:17 16:8 215:17</p> <p>actual 137:14</p> <p>actually 4:13 6:10 13:4,7 21:12 26:2 26:20 44:24 63:20 71:20 72:16 76:4 83:10 86:8,20 88:18 89:12 93:19 95:23 96:10 97:23 99:11 108:10 111:21 154:7 162:18 170:19 191:2 201:20</p> <p>adapt 13:17</p> <p>adaptations 13:25</p> <p>adaptive 13:18</p> <p>add 11:20 72:12 74:19 79:17 104:19 223:5 223:13</p> <p>added 74:17,22,25 76:2</p> <p>addition 77:25 89:24 202:6 205:2</p> <p>additional 3:8 47:4 74:5 94:8 202:11</p> <p>additions 90:13</p> <p>address 2:24 3:1 5:13 6:17,23 8:1 75:11 112:10 116:1,10 122:12,19 125:4 139:18,25 143:12 173:11 183:20 191:21 210:21</p> <p>addressed 3:4 7:10 13:1,2 55:22 121:24 122:1,2 124:3 150:1 151:17 165:13 168:17 171:15 172:1,7 190:9 195:5 197:23</p> <p>addresses 150:5 168:7 171:16 192:21</p> <p>addressing 2:14,17 7:23 32:7 130:20 138:19 150:12 159:13 172:20 182:23 198:12</p> <p>adequate 214:20</p> <p>adjourned 115:12 224:17</p> <p>adjudication 147:8,9 150:22,24</p> <p>adjust 82:20 83:2 87:19 111:10</p>	<p>Adjusted 187:4</p> <p>adjusting 85:11 108:16</p> <p>adjustment 84:15 108:14</p> <p>adopt 120:8 132:25 218:11</p> <p>adopted 128:21 155:4 175:15 218:25</p> <p>adopting 174:25</p> <p>adopts 75:3</p> <p>advance 8:23 198:11 210:1</p> <p>advanced 222:19</p> <p>advancements 213:22</p> <p>advances 51:15 65:12</p> <p>advancing 221:13</p> <p>advantage 42:9,25 90:18 110:1 203:19 203:20</p> <p>advantages 29:20 43:1 51:10</p> <p>adverse 157:17 203:25 215:17</p> <p>Advisor 2:5,13,14</p> <p>advocated 112:15</p> <p>Affairs 2:5</p> <p>affect 59:14 70:24 103:15 209:4 210:11 213:5</p> <p>affected 26:3 54:5 55:4 56:3 93:5 165:22 209:10</p> <p>affects 50:1 89:25 101:12 108:11 110:12</p> <p>affirmatively 132:6</p> <p>affirms 189:4</p> <p>afflux 188:18</p> <p>afford 55:19 186:25</p> <p>affordable 73:6</p> <p>Afghanistan 41:10</p> <p>afraid 220:5</p> <p>after 2:16 18:11 30:21 39:12 45:11 59:19 60:12 74:4 78:25 91:5 114:10,14 119:24 127:6 133:9 137:11 155:3 219:5</p> <p>afternoon 4:8 114:1 115:7</p> <p>afterthought 185:17</p> <p>afterwards 170:25</p> <p>again 1:4 5:12 10:25 29:9 38:7,7 39:6 51:24 56:1,13 67:12 68:23 79:1 81:5,9 84:8 85:13 87:8 88:25 89:2 111:11 114:14 115:15 118:6 119:20 128:3 128:21 130:5,9 138:7 142:11,13 146:10 155:10 156:2 176:4 177:17 184:5,9,20 189:9,24 191:4 192:11 196:25 197:17</p>	<p>200:18 202:16,19 204:13,20 205:13 216:22 224:12</p> <p>against 18:7 44:23 103:16 116:19 119:7 154:16 155:12 156:9 159:19 164:22</p> <p>agencies 44:4,5,6,9</p> <p>agency 44:9 85:23</p> <p>aggregate 206:3</p> <p>aggregating 81:12</p> <p>ago 13:15 21:9,9 30:24 45:3 58:20,20 59:17 103:22 111:20 158:21</p> <p>agree 44:6 141:5 187:5</p> <p>agreed 133:21 174:23</p> <p>agreement 47:1 180:17 187:15 190:12 208:25 219:6,7</p> <p>agreements 184:23</p> <p>agricultural 14:6 205:7</p> <p>ahead 32:3</p> <p>Aide 186:25</p> <p>air 11:4</p> <p>Alberta 103:20,23</p> <p>ALI 2:4</p> <p>aligns 134:11</p> <p>allocate 48:24</p> <p>allocated 185:24</p> <p>allocates 48:25</p> <p>allow 4:5 68:21 83:23 85:2 93:11 162:23 169:21 206:23 221:21 222:23</p> <p>allowed 179:21 219:7</p> <p>allowing 90:20 191:7</p> <p>allows 19:7 29:6 31:25 69:25 75:6 84:14 92:13 110:1</p> <p>almost 61:5 68:8 79:6 89:19 97:23 106:19 168:21 224:12</p> <p>alone 186:17</p> <p>along 17:15 42:17 56:15 61:15 69:1 106:24 115:7 162:11 167:8</p> <p>alongside 171:12 182:11</p> <p>already 3:4 4:18 20:6 20:12 48:20 84:20 100:4 121:16,18 122:16 123:17,18 123:20 149:11 157:3,4,18 158:3 159:9 168:7 186:7 196:11 198:19 208:5 213:5 218:7</p> <p>Alright 115:6</p> <p>alter 49:7 186:5</p> <p>alternative 33:25 115:2 216:11</p> <p>alternatives 103:16</p>	<p>although 68:23 90:6 163:9 203:20</p> <p>always 3:12 33:24 48:15,22 86:15 109:6 129:23 213:7</p> <p>AL-KHASAWNEH 1:10</p> <p>Ambassador 2:6</p> <p>ambitious 104:7</p> <p>amenable 14:13</p> <p>amended 162:23</p> <p>America 27:20 103:19 110:14</p> <p>American 50:12</p> <p>among 136:4 175:8</p> <p>amount 19:15 24:12 30:21 45:16 68:10 69:5 75:16,23 76:11 77:15,17 89:9 95:9 99:15 100:24 108:11 110:6 113:25 185:14 204:13 205:10 213:5 217:25</p> <p>amounts 206:5</p> <p>amplified 108:8</p> <p>analogous 77:2 149:17</p> <p>analysed 148:21</p> <p>analyses 77:20</p> <p>analysing 72:15 185:16</p> <p>analysis 6:14 75:8 88:21 94:11 112:3 117:5 135:15 138:11 145:25 215:13 222:1</p> <p>analytical 222:23</p> <p>Anchicayá 45:2</p> <p>ancillary 70:23 78:11 79:7,11,15,17,19,23 83:4,9,11,21 84:6 85:17 86:17 94:10 99:2 100:16,20,24 101:8 102:2,8,19 103:10 104:10,11</p> <p>angle 36:17,17</p> <p>Annex 124:19</p> <p>annexure 1:1 7:15 8:19 10:12,15 124:17 135:7,18,24 136:11 140:8,12 141:3 142:6 144:3 157:7 160:22,23 167:21 172:15 173:9,13,20,24 174:5 178:5,6 179:14 180:10 183:11 191:6,9,13 191:15,19 192:4,5,7 192:9,12,16,18,23 192:25 193:1,11,16 194:14,22,24 195:19,22,23 196:1 196:18,20,23 197:11,13,17,19,23 198:8,17,19,20 199:4 200:22,25 205:8,12,22 206:3</p>	<p>209:23 210:21,25 212:1,20 217:7 218:3,4,13,22 219:18 220:6,10 223:6</p> <p>annexures 184:12 189:23 191:3,15 193:17 196:12 205:17</p> <p>announced 103:20</p> <p>annual 27:22 30:8</p> <p>annually 111:17</p> <p>another 3:5 22:7,9 23:23 33:18 39:1 52:25 54:8 55:3,4 73:11 97:3 99:16 106:21 116:9 120:19 146:5 174:2</p> <p>answer 19:11,12,13 32:11 57:23 58:10 58:16 59:6 107:15 113:13,14 138:20 154:4 164:13 188:25 191:25 220:17 221:10</p> <p>answered 139:16 219:19 220:7</p> <p>answering 221:1</p> <p>answers 119:25 138:25 170:19,20</p> <p>anticipate 103:7,9,17 111:12 163:9</p> <p>anticipating 59:18</p> <p>anything 4:5 34:3 36:20 49:6 95:3 108:13 181:10 198:21</p> <p>anyway 19:13 46:14</p> <p>anyways 100:2</p> <p>anywhere 45:13 78:19</p> <p>apart 194:10 213:17</p> <p>apologies 115:14 206:15</p> <p>apologise 122:5</p> <p>apparent 3:12 117:13 117:22</p> <p>appeal 212:21</p> <p>appear 8:5 145:14</p> <p>APPEARANCES 2:1</p> <p>appeared 113:3 187:14</p> <p>appears 75:17 126:14 146:24</p> <p>appendix 187:2</p> <p>applicable 124:25 143:8 146:20 167:22 169:2,7 192:8 220:11</p> <p>application 6:15 75:2 75:12 117:19,25 118:3,5,11 121:7,22 122:14 123:12 124:10 134:22 135:3 137:3,25 140:17,22 144:6,15 152:1 154:2,14,18 154:23 155:3 157:16 158:19</p>
--	---	---	---	---	--

<p>159:8 162:17,23 163:12 168:23 194:13 applied 13:4 149:22 149:23 applies 137:18 141:19 147:24 159:2 185:19 apply 3:21 10:22 25:11 32:17 46:7 153:2 156:24 157:2 160:13,18 163:19 164:7 167:3 172:4 173:2 175:3,16 178:9 216:14 applying 167:23,24 221:14 appointed 172:10 appointment 117:9 apportioning 49:23 apportions 49:3 appreciable 26:7 60:3 appreciate 5:23 8:3 11:10,13 65:4 182:16 appreciated 1:10 appreciates 177:5 appreciation 68:17 72:17 215:6 approach 10:25 50:14 109:14 123:24 128:22 136:3 165:16 174:24 213:21 215:5 217:2 217:5,6 218:12,18 218:24 approaching 4:10 35:3 appropriately 20:15 57:24 Arabian 19:4 arbitral 147:7 arbitration 1:1,4 2:18 2:21 6:21 7:7 116:21 117:9 118:18 121:12,13 125:3 126:1 130:18 133:9 134:13,17 136:2,10,25 137:23 138:9 139:2,2,20 140:2,3,6,11,24 141:18 142:2 151:7 151:10 156:17 157:22 159:22 160:12 161:10 163:3 167:19 168:8 168:13 169:20,23 172:2,12,22 173:14 174:8,12 176:13,18 178:17 179:16,18 179:22 180:2,7,24 181:4,14 215:20 217:11 arc 65:1 architecture 176:11 area 16:25 18:20 25:18 28:19 32:13 37:2,14,17 45:7</p>	<p>49:18 55:4,24 56:12 62:4 69:24 86:1,4,5 88:25 89:6 90:2 98:2 106:15 205:10 214:8,9 areas 14:16 21:15 27:20 51:13 55:14 55:15 93:22 187:5 arguably 165:25 argue 177:16 185:20 argued 112:13 arguing 176:17,19 argument 194:19 214:7,11 216:4,14 arguments 214:19 arise 120:24 121:2 140:15 173:13 180:16 200:23 arisen 124:14 arises 117:7 118:17 171:24 174:8 210:22 arising 171:10 199:10 Army 44:2 around 8:18,21 9:16 13:24 16:21 17:23 25:24 26:12 61:13 69:5 70:6 83:19 93:1 94:3 98:19 103:8 110:9 158:10 165:13 168:21 189:3 195:14 arrangements 109:2 209:21 arrived 28:3 arriving 53:20 72:13 art 195:12 218:14 article 1:1 2:21,25 8:19 9:8,9 43:10 119:13 120:9 127:9 135:20,20,20 140:14,20 142:5 143:1 146:6 149:7 168:1 173:5 180:23 183:13,14,22 185:2 185:7 186:1 188:5 189:5,7,21 193:7,15 194:13,22,23 195:6 195:18 196:2,8,9 197:2,9 202:22,25 203:1,9 204:7,9,15 204:21 205:2,4,6,7 205:15 208:22,24 209:18 211:9 217:4 217:5,6 218:19,21 Articles 193:23 194:1 artificial 10:14 artificial 42:16 145:11 ASAD 2:5 ascertain 148:6,8,13 aside 160:8 asked 6:19 106:1 167:11 asking 109:12 113:1 224:9 aspect 159:3 aspects 4:24 63:17 73:15 102:24 120:1</p>	<p>146:13,14 169:7 182:11 asserting 120:12 125:24 asserts 126:2,8 assess 148:23 assessed 20:18 assessing 155:16 assessment 72:6 213:23 assessments 214:5 assistance 160:2 219:5 Assistant 2:20 associated 63:7 65:14 66:18 72:24 75:12 127:7 185:22 192:17 assume 109:21 111:14 132:18 assuming 33:19,20 assumptions 75:8 assured 19:4 75:23 76:5,8 Aswan 19:19 attach 6:24 attaches 147:3 attempt 3:13,15 146:5 154:20 222:18 attempting 125:19 attention 55:12 133:16 ATTILA 2:11 Attorney 2:6 attribution 10:11 August 187:11 190:10 190:17 Austria 216:9 authoritative 126:4 177:1 automatically 84:14 availability 46:25 72:23 75:24 83:9 97:16 available 20:9 25:6 51:17 68:21 71:7 72:6,15 74:3,9 75:21 76:6,8,24,25 77:15,16 78:16,22 79:3 81:10 82:16,18 83:1,21 85:8,24 87:7,25,25 88:2,16 89:7,8,8,23 91:8,16 91:23 93:12 95:24 96:4,6,7 98:4,7 99:10,15,20 100:13 100:17,20 101:10 101:13,16 103:18 104:3,6,23,24 110:4 129:22 217:9 219:9 avails 10:5 average 48:22 76:4 86:11 213:4 averages 92:15 avoid 23:24 134:7 137:1,15 158:1 204:23 214:17 avoiding 117:2 award 6:24 116:18</p>	<p>121:18,25 122:1,7 123:23 125:15 132:15,18,22,23 140:10 141:8,12,19 141:19,20,20,21,23 142:16,22,24 143:14,15,18,20,22 144:1,8,11,12,23 145:3,7,9,12,13,23 146:7,15,25 147:2 147:21 150:4 151:2 151:9,22,23 152:25 154:13,15 155:6,11 156:12,18,20 157:1 157:4,19 159:7 161:18,19,20,23 162:1 163:14,24 164:4,8 166:20 167:8,15 171:13 172:8 174:14,22 175:16,19 177:21 200:8 201:12 awards 119:4 120:11 123:7,16 125:8,12 126:15 127:6 131:7 137:20 141:7,24 150:18 157:9 161:10 162:15 168:8,13 178:18 award's 156:1 aware 11:21 132:19 away 7:17 18:1,10 27:11 155:4 177:19 AWN 1:10 axis 83:17 86:2,8 88:24,25 201:14 A3 116:9</p>	<p>124:16,19,23 125:10,18,24,25 126:2,8,12,25 127:14 128:3,6,10 128:14,17 129:8,11 129:20,23 130:3,9 130:14,23 131:5,11 132:1,21 133:1 135:12 136:20,22 137:19 157:13,14 161:17 174:19,24 175:16,21,23 176:4 176:17,22 177:1,11 177:18,22,25 178:9 181:11,17,18,19 182:4,9 Bajo 45:2 balance 59:19 189:17 189:20 balancing 72:11 Bank 186:25 187:4,9 191:5 219:6 banks 40:2 bank-financed 38:10 48:14 bargain 3:24 2:25 8:14,16,16 155:15 155:19 182:21,24 183:1,7,18 184:1 185:23 186:10 189:10,25 192:3 197:4 200:3,14 202:18 205:14 207:25 210:3 217:3 218:23 bargains 8:15 219:4 barrage 19:2,3 barrages 52:19 barring 114:12 base 110:16 based 13:12 39:6 58:21 94:6 111:14 112:19 147:6 166:5 baseload 86:9 87:9 99:20 100:11 102:19 basic 12:17 13:15 112:21 142:7 149:3 196:4 basically 13:14,22 22:8 24:22 25:15 28:24 32:20 38:20 39:8 42:21 43:7,19 43:24 44:3,18,20 49:20,24 53:18 54:6 55:14 62:2 132:5 195:13 basin 71:11 185:2 197:11 basins 70:10,11 200:15 basis 7:11 29:3 30:9 58:1 86:14 91:17 92:14 112:1 134:23 135:8 165:11 166:17 209:22 214:21 basket 72:9</p>	<p>batteries 69:5,6 91:20 95:13 97:19 106:24 110:4 battery 79:9 96:16 97:21,23 104:2 bear 1:23 bearing 131:21 beautiful 38:22,23 become 63:10 70:7 becomes 61:25 74:8 109:4 becoming 111:20,21 bed 26:18,25 27:5,8,8 35:16 59:23,23 beds 47:35 48:1 bed-load 25:16 before 1:9 1:14 2:4 5:25 15:14 16:18 19:4 20:1,4 60:11 64:11 86:25 91:8,12 116:11 117:7,13,23 117:25 118:4,5,12 118:16,22 119:2,8 119:18 120:19,22 127:8 130:16 133:7 133:22 134:9 137:7 138:15 143:10 147:11 148:23 153:20 154:25 156:23 162:16 167:19 169:18,21 169:22 170:11,22 171:9,10,18 179:2 181:3 206:17 211:15 begin 11:3 beginning 50:20 57:3 64:18 65:3 117:5 210:1 behaviour 111:8 behind 113:24 145:2 188:5 201:3 being 13:4,9 17:17 20:21 21:24 42:24 46:11 53:17 68:13 75:9 79:9 94:14 99:12 107:6 112:15 136:18 137:1 150:19 165:11 177:1 181:11 186:17 187:18 199:13 200:18 218:10,16 Belgique 147:19 believe 7:6,7 8:18 54:9 75:14 115:16 believed 165:6 below 29:17 33:10 45:21 67:24 82:11 86:9 129:3 152:11 152:22 154:21 198:23 214:9 benefit 100:5 102:9 138:21 149:10 benefits 70:23 78:12 83:5 86:17 93:12 99:2,9 102:8,19 103:11</p>
---	---	--	---	---	--

<p>bespoke 184:21 best 3:2 93:24 100:23 136:12 175:3 204:4 212:22 213:22 214:2,11,12,17 215:24 216:4,15,15 216:17,23 218:24 221:18 Bethlehem 2:9 3:2 better 38:12 51:13 68:17 150:1 201:20 between 1:15 28:24 32:13 43:25 57:14 67:15,18 74:7,12 76:16 80:11 83:18 87:10,12 97:7 98:14 98:16 116:20,23 117:2 118:2 122:24 123:3 124:18 127:5 127:7 133:16 136:24 143:5 144:13 145:16 148:20 162:1 171:25 173:22 176:11 183:14 191:14 193:7,9 197:2 211:1 beyond 6:15 7:4 124:3 125:25 135:17 136:20 144:10,19 148:4 153:19 155:6 162:6 163:24 164:25 166:13 177:19 204:12 big 17:12 18:17 30:9 31:21 32:13 35:19 35:20 42:22 46:16 48:15 54:14 57:5 58:4 86:20 93:25 213:15 bigger 16:18 31:11 biggest 53:9 95:2 billion 58:4 bills 72:19 75:18 Bin 146:22 147:18 bind 155:15 binding 7:13 120:10 121:12,15 123:8 125:1,15,25 126:5 126:13,17 128:22 129:12 130:16,18 132:7 135:8 136:23 138:2,8 139:2,3,10 139:11 140:1,5,13 140:25 141:9,24 142:1,16,18,21 144:4,4,9,23 145:16 145:21 146:4 151:9 151:11 155:2,5 156:4,6,16,21 157:24 158:11 160:10 161:11 162:19 163:3 168:8 168:12,15 172:11 172:18 173:25 174:16 176:6,12,14 176:17,19,23 177:2 177:3,13,16,18</p>	<p>178:19,24,25 179:18,23 180:3 181:6,13,17 bioenergy 92:4 biomass 89:22 bit 2:9 11:12 13:11 21:20 26:11 35:10 53:11 57:11 64:7 78:8 83:24 91:20,24 112:9,25 113:24 114:4,18 132:1 169:15 170:8,10,18 221:5 bits 94:21 black 32:22 67:25 78:24 Blackmore 1:11 15:10 15:12 16:10,12,15 19:17 20:16,22 blank 208:18 BLINK 2:21 blip 17:6 blocking 21:4,22 blocks 48:2 block-loading 83:7 blow 11:5 blue 68:9,14 79:5,10 97:4,18 122:8,11 139:10 board 44:6 bodies 119:13,15 135:9 body 126:16 146:7 148:22 bordering 215:11 born 65:5 Bosnian 149:4 both 3:17 36:11 49:9 50:1,15,16,17 51:10 65:17 66:19,22 68:15 90:6,25 91:1 96:16 104:12,13 117:8 119:14 120:25 121:13 123:9 124:24 126:24 127:10,25 128:23 131:6 134:22 136:18 137:7 151:12 156:6 160:3,15 178:9 190:11 207:12 bottom 27:1 28:2,14 28:19,20 29:18 38:6 43:3,5 44:14 66:16 79:8,10 83:16 86:3 86:9 88:7 97:4,18 203:1 bought 19:20 boulders 26:4 56:4,11 bound 222:10 breach 140:18 149:11 break 62:11,16 114:5 114:11,13,14 115:3 115:8 169:12,13 170:2,10,24 171:4 171:10,18 224:7 bricks 3:9,13 bridge 188:18 189:3</p>	<p>195:14 bridges 53:14 brief 2:6 71:19 101:5 188:8 briefe 163:18 172:7 briefest 1:16 briefly 116:15 183:16 191:24 213:25 219:20 bring 78:25 93:7 110:15,16 149:8 195:25 196:1 211:13 220:5 bringing 212:22 brings 4:18 89:15 193:6,8 broad 142:4 195:15 broader 106:8 130:9 163:25 164:15 166:1,4 168:18,24 182:5 broadest 11:2 broadly 135:25 165:10 166:6,17 brought 52:5 153:13 brushes 11:2 BRYCE 2:20 bucket 18:3,7 buffer 85:7,16 95:13 101:14 buffering 96:17 102:3 buffers 107:9 build 33:24 57:9 59:2 178:1 building 1:18 2:7 11:2 60:24 155:22 Buildings 2:10,11 builds 210:16 built 17:17 37:25 105:21 114:1 205:18 bulk 18:21 bulldozer 56:12 bundles 91:11 buried 37:22 BURKI 2:5 business 224:3 buy 17:20 Buying 23:11 Buytaert 1:12 51:21 51:24 54:7 56:21 57:10 59:5 105:10 105:13 106:5,7 107:21 220:3,4,17 220:22 Buytaert's 59:10 bypass 25:9 26:10,11 27:5,13 195:15 by-pass 188:19 B(1) 152:17 158:17 B(2) 158:17 B(3) 152:18 B(4) 157:20 158:16,22</p>	<p>calculated 112:22 calculating 112:13 129:20 calculation 102:14 106:11 107:10 calculations 105:19 California 96:20,25 97:6,20 call 36:2 45:22 52:2 58:9 84:6 89:4 called 7:24 16:15 28:9 78:15 92:7 99:6 came 31:1 56:10,11 187:8 216:5 CAMERON 2:10 Canada 94:23 185:2 canals 30:18 41:23,24 48:7 53:19 canon 167:16 193:22 193:25 194:11 capabilities 70:21 72:22 74:21 capability 70:8 75:22 99:22 100:3,4,11 212:13 capable 140:23 capacities 12:24 capacity 12:16 17:16 20:12 22:11 26:5 29:20 30:7 42:3 52:18,20 57:13 67:15,18,20,21,23 68:1,11,12,15,23 69:1,17,18 70:15 72:24 73:10 76:9 81:11 88:4 92:11 97:21 190:15 201:15 205:20 206:3,19,21,22 220:10 capita 66:20 capital 73:11 193:1 capture 93:11 103:10 captured 12:5 career 50:21 careful 166:21 carefully 134:6 169:6 Caribbean 27:20 carried 204:25 cars 109:20,23 110:2 carve-out 10:9 187:13 cascade 22:5 42:4,5,6 42:25 43:1 60:25 61:2,14 casades 60:21 case 1:3 2:21 5:22 6:4 9:17,18,20,23 23:19 24:4 33:9 40:20 53:5 56:4 57:24 59:18 61:4 76:3 85:22 98:6,15 99:1 107:11 111:21 118:18,19 119:6 120:12 122:15 123:13 127:18 130:16 133:5 135:13 142:10 147:19 148:17,20</p>	<p>148:24 149:1,5 151:15,17 153:14 160:5 164:11 177:12 203:22 211:6 223:17 cases 29:12 36:11 76:5 113:2,3 152:12 cast 159:9 202:21 casting 158:1 cat 50:14 catastrophic 18:9 21:3 categories 121:20,24 122:9 138:11 208:17 caught 9:19 224:2,11 cause 40:6,6 209:3,7 215:10 caused 21:3 188:18 189:1 causes 82:12 188:11 cautious 127:13 128:9 CEA 69:10 cement 76:16,19 cemented 3:11 cent 22:19 23:5 central 5:22,23 6:4,4 centred 154:1 cents 23:5 92:22,24 93:1,24 94:6 century 13:2 64:16,19 65:3,6 70:3 certain 9:4 31:9 34:16 34:17 43:1,1 49:4,5 49:16 55:14 57:13 61:2,24 85:19 95:9 110:4,15 111:4 117:23 120:20 155:22 158:6 163:24 169:3 179:13 185:3 188:1 197:20 207:16,18 certainly 3:14 58:14 59:5 103:19 113:10 113:15 132:16 133:21 145:17 147:25 164:2 165:1 165:14,15 166:3,15 167:15 177:6 182:6 192:13 194:6 215:25 certainty 126:23 211:13 cetera 14:1 18:22 26:17 31:15 41:3 45:9 48:7 62:1,5 135:17 Chairman 1:3,8,14,21 3:6 7:16 8:20 10:20 11:9,19 12:9 15:10 23:15 32:4 33:18 35:11 51:21 59:8 60:20 62:6,13,14,18 62:22 105:7 107:22 112:6 113:9,18 114:7,24 115:6,10 115:14,19 131:21 131:22 133:6 143:10 145:6</p>	<p>146:10 149:25 150:17 158:4 163:20 165:15 167:18 169:10 170:3,23 171:6,8 179:9 180:11,25 181:2,9,21,25 182:15,22 191:10 191:11,21 192:15 192:20 193:21 206:2 219:13 220:3 220:7,23 221:18 223:17,23 224:5,14 challenge 17:3,11,13 180:5,6 181:4,16 challenged 146:4 179:15 180:11 181:7,12 182:2 challenges 17:12 change 5:11 15:3 19:23 48:10,12,15 48:19 49:1,8,21,25 50:5,6 54:9,13,17 66:11 85:6 95:10,11 100:8 102:11 108:7 108:10,13 109:18 109:22 111:9 112:21 163:11 164:10,23 165:1,10 165:23 166:5,8,13 166:16 188:11,16 188:22,25 200:21 213:2,4,20,20 changed 16:22 65:16 66:3 73:14 164:4 167:1 187:19 201:16 changes 28:11 78:17 81:2 84:2 85:6 96:17 99:5 101:3 106:13 107:2 109:18 162:24 165:8,18 changing 54:17 106:15,18 108:15 203:14 214:1 channel 31:8,12,23,24 34:16,18 43:4,11,13 43:15 chapeau 197:9 202:7 character 108:21 140:5 characterise 217:14 characterised 8:17 201:21 characterising 9:6 characteristic 61:23 87:3 104:15 161:3 characteristics 63:13 78:1 82:1 90:25 charged 109:21 chart 70:14 78:8,10 cheaper 22:23 cheapest 22:22 23:6 check 105:8 133:22 134:3 Chenab 37:5,5 38:13 42:17 53:6 54:4</p>
--	---	---	--	--	--

<p>190:22 202:8 Cheng 146:22 147:18 Chile 25:22 China 30:20 39:2,9 43:9 216:9 choose 155:23 circle 196:13 circumstance 179:12 circumstances 32:4 33:22 117:8 118:17 121:23 122:15 136:8 137:12 152:2 162:25 163:8,24 164:7,23 165:8,23 166:13 167:2 circumvent 142:24 216:23 218:12 citation 169:5 cite 139:8 cited 118:24 119:3,5 136:14 147:12 216:8 cites 146:24 147:18 citing 217:10 civilisation 19:18 claim 180:14 claims 211:14 clarification 153:12 154:12,19 155:8 158:20 clarification/interpr... 155:1 156:2 clarify 220:15 clarity 131:6 classification 89:21 clause 147:25 148:1 148:15,19 196:10 204:1 cleaning 171:10 clear 13:10 24:17 30:21 31:2 33:14,15 49:11 50:3 51:25 67:24 92:3,17 114:21 120:5 124:25 125:15 131:3,4,24 132:1,20 133:19,25 140:10 141:11 150:7 154:22 155:25 159:1 171:21 172:14,16 176:10 177:5 181:16 188:13,24 191:16 195:16 200:9 201:17 220:8 cleared 56:12 clearest 154:24 clearly 9:18 35:10 102:20 106:9 133:18 152:7 169:6 171:20 186:15 climate 5:11 14:13 48:9,12,14,19 49:8 49:10,21,25 54:9,13 54:17 163:11 164:10,25 165:10 166:5,16 213:2,4 climate-sensitive 49:2</p>	<p>close 1:21 30:10,15,16 36:16 46:21 48:8 51:16,19 56:14 83:20 151:14 169:11 170:1 closed 173:6 closely 113:5 223:1 closer 23:10 79:8 90:19 closing 8:10 clouds 98:1 coal 67:4 68:2 91:9 93:21,21 coal-fired 87:21 103:21,21 coated 37:20 48:4 coatings 13:21 14:1 51:13 213:9 cobbles 35:20 46:2 code 139:9 coffee 62:11 114:13,14 115:3,8 169:12 170:10,24 224:7 cofferdam 26:24,25 cognisant 51:3 coincide 15:24 193:4 cold 11:4 collapsing 40:6 colleague 171:14 colleagues 4:20 105:8 105:25 collected 31:1 collects 45:25 Colombia 25:17,18 45:2,5 145:4 148:18 Colombian 45:9 colour 66:1 68:9,14 96:24 97:19 139:9 colouring 122:8 colour-coding 178:16 Columbia 185:1,4 column 92:3 208:18 220:9,13 columns 78:8,10,21 combination 73:9 76:1 104:9,20 142:4 combine 193:10 combined 77:21 combined-cycle 93:19 come 8:9,20,22 9:18 10:19 38:6,7 57:8 59:19 68:6 70:23 85:20 89:1 94:22,24 96:13 106:4 107:10 111:3,6 113:15 115:1,6 150:15 154:7 162:5 168:25 170:24 184:8 187:23 192:2,13 193:18 201:25 206:24 207:1 211:21 213:19 218:17 220:15,20 221:12 comes 10:6 22:8 29:16 41:10 49:25 50:7 52:25 54:19 58:25 71:11 76:19 80:16</p>	<p>86:25 95:21 97:25 100:25 101:9 169:24 218:2 comfortable 170:7 coming 1:22 4:17 38:3 41:10 50:4 56:4 90:5,12 92:19 100:19 102:15 103:6 104:23 105:1 106:20 114:11 144:16 189:6 191:24 196:17 200:13 212:19 219:3 comity 137:18 commenced 127:8 commences 211:16 commensurate 173:9 comment 15:2 63:5 214:15 comments 11:10 48:9 71:19 commercial 65:2 147:19 Commission 127:5,17 127:20 201:6 209:18,20 210:15 223:15 Commissioner 2:4 7:3 119:2,4 122:25 123:1 127:23 128:4 128:8,13,21 129:18 131:12 208:9 209:24 210:16 211:5,6 Commissioners 118:25 173:23 common 78:7 92:14 93:20 166:24 218:9 commonplace 166:24 communicate 209:25 communicated 157:6 communities 61:13,14 61:17,19 62:3 comparative 39:18 comparator 184:18 compare 37:1 45:16 58:1 92:13 compared 16:7 19:15 35:17 103:16 159:23 comparison 37:4 93:15 compartmented 25:10 25:11 compatible 196:3 213:10 compelled 194:14 compendium 170:16 compete 103:12 competence 116:18 121:18,21,25 122:1 122:2,3,7,11 126:16 134:15 136:6 137:13 139:12 140:22 141:2,6,8,20 141:23 142:4 145:23 146:8,9</p>	<p>149:23 159:17,18 159:22,24 160:4,6 168:16 172:13,18 172:24 173:5,15,21 174:1,3,4,10,14,16 178:25 179:4,14,17 179:25 180:2,4,12 180:15,21 181:5,11 181:23 competencies 136:24 competent 124:9,11 124:16 150:19 173:11 competing 193:25 211:14 214:19 compiling 170:17 complement 95:4 complementary 70:1 91:1 complete 114:20 196:13 completely 6:2 26:4 35:7 55:1,1,8 56:19 60:15 100:13 132:21 completion 11:17 complex 72:21 compliance 124:18 185:16 195:19 210:7,17 211:17 compliant 29:18,19 210:23 complicated 89:13 107:11 complied 199:14 comply 199:21 207:6 219:19 complying 33:23 196:15 component 68:24 components 212:8 comprehensive 214:16 comprised 134:18 comprises 68:15 computation 75:4 101:19 compute 101:15 computed 75:19 76:2 81:11 112:9 computing 92:10 compétence 174:7,7 conceded 130:4 conceived 200:24 concentrated 43:17 concentrating 92:7 concentration 38:16 41:7,18 concentrations 30:6 41:11,14 53:16 concept 52:1 163:23 166:20 172:3 184:22 concepts 198:11 199:22,23 conceptual 35:4 57:11 concern 21:7 52:4 concerned 135:11,25</p>	<p>172:19 173:1,1 concerning 117:18,24 120:25 121:3 140:16 141:17 182:4 214:23 217:21 concerns 7:9 63:25 119:11 120:20 156:19 214:25 concession 187:10 191:6 conclude 50:9 105:6 178:12 179:6 concluded 175:10 178:3 212:16 214:20 concludes 219:11 concluding 139:24 conclusion 21:10,17 136:8 137:21,23 139:22 150:9 177:25 178:7 203:16 conclusions 5:18 6:3 103:3 conclusive 127:23 concrete 51:6 55:17 76:16,18 175:23 condition 60:11,12 76:4 202:7 conditioning 196:14 conditions 41:17 52:17 54:12,18 92:16 188:1 192:10 195:25 199:19 202:8,16 212:14 214:1 conduct 214:6 conducted 214:13 cone 21:14 36:14 confess 23:16 configured 91:22 93:9 confined 6:8,12 173:16 confirm 121:9,15 134:8 146:25 190:5 210:23 confirmed 74:5 136:3 140:7 141:23 142:8 146:21 149:21 151:14 217:24 confirms 173:21 conflicting 137:16 conform 196:24 confuses 206:14 confusing 169:16 confusion 169:24 conjunction 32:9 connected 22:8 connection 37:14 120:16 125:13,22 133:2,4 136:1,15 144:16 165:10 166:20 172:25 178:23 179:3,25 181:18 182:3 connectivity 90:23 98:9</p>	<p>consent 137:8 consequence 182:6 consequences 18:9 35:7 43:18 122:17 157:17 consequently 150:22 conservation 14:17 consider 33:12,13 41:25 128:5 209:9 considerable 14:14 consideration 71:12 138:7 155:14 175:5 215:9 considerations 5:12 57:16 considered 44:20 76:5 101:3 130:5 131:2 176:3 193:22 considering 65:4 72:22 considers 153:18 164:19 201:17 consistency 90:24 127:10 202:3,7,16 consistent 125:9 127:22 128:21 134:10 174:13 190:18 200:18 204:14 212:4 219:1 consistently 123:6,25 125:11 consists 183:1 constant 80:20,21 81:1,22 108:3 189:19 210:6 constituencies 172:21 constituent 178:20 constitute 140:18 152:16 constituted 146:3 155:13 constitutes 143:13 constituting 176:23 constitution 117:8 145:25 constrain 97:9 196:18 constrained 9:4 10:3 71:8 103:14 183:8 207:24 constraining 191:9 197:18 constrains 207:19 constraint 3:24 61:16 constraints 3:21 33:19 34:2 72:1 97:9 103:14,15 155:19 175:9,14 197:6 200:11 212:23 construct 205:16,21 207:20 209:2 222:2 constructed 8:17 120:14 205:24 206:4 212:9 construction 15:1 69:12 123:18,21 136:13 155:20 157:5 208:21 210:2 210:5 211:3,7,15</p>
---	---	--	--	---	--

<p>215:23 216:18 221:22 construe 194:23,24 construed 10:3 194:3 construing 10:23 194:23,25 consultation 208:6 209:15 223:16 consume 104:9 consumed 64:13 consumption 66:20 75:18 203:17 contained 151:9 contend 98:6 contended 216:6 content 148:8 170:10 context 49:6 52:4,5 60:21,23 116:14,15 118:15 159:3,20,22 161:4 164:3,22 165:2,3,25 173:3 175:20 182:7 188:2 192:1 194:15 202:20 205:13 215:18 Continental 148:3 contingency 114:1 contingent 195:19 continue 1:15 2:5 3:23 25:7 61:2 65:9 119:19 continued 3:4 12:13 64:17 117:11 137:10 148:11 175:24 continues 93:4 120:8 120:18 125:17 continuous 45:14 88:7 88:10 continuously 45:15 82:9 219:8 contract 47:1 contractor 37:25 contradict 120:9 contrary 159:19 180:6 contrast 15:12 29:10 125:11 130:18 134:24 161:11 176:6 contrasting 125:2 176:4 contribute 79:17 83:3 contributes 84:5 contribution 79:3,15 84:3,24 97:11 contributions 79:11 contributors 89:21 control 13:23 15:8 23:21 32:22 33:25 34:24 41:13 42:15 42:24 60:23 81:23 82:17,22,24 83:13 84:1,17,17 86:18 110:24 154:17 162:7 164:25 166:10,13 187:6 200:17 202:23 204:18,23 205:4</p>	<p>212:14 215:1 218:5 controlled 20:2 81:20 controlling 2:25 136:23 138:8 140:1 176:12 Convention 135:16 193:24 194:6 conventional 223:9 conventions 184:17 conversion 80:4 convert 80:16 converted 31:20 34:11 converting 25:23 converts 46:7 cooperate 208:25 210:13 cooperating 208:20 cooperation 183:17 189:19 208:1,6 209:17 210:4,14,24 211:1 219:10 cooperative 184:25 208:4 coordination 116:20 117:2 core 66:2 corner 43:6 corollary 185:8 Corps 43:22 44:2 correct 18:21 38:10 62:13 108:16,25 110:12 133:17 146:18,18 213:21 218:18 220:1 correction 83:3 correctly 8:18 27:4 correspondence 127:7 130:11 corresponding 9:2,11 199:14 cost 22:22 23:4,12 24:18 35:24 46:23 46:23 47:4 58:3 62:5 73:3,9 92:10 92:11,20,24 93:2,18 93:24 94:8,13 103:4 103:12 costing 74:3 costly 44:12 55:19 57:25 costs 47:5 72:15 92:2 92:12 93:7,8 94:7,9 111:4 cost-effectiveness 65:15 Counsel 2:20,20 count 100:5 countered 214:11 counterpart 7:4 countries 17:8 73:14 90:7 104:7 country 14:16 17:11 22:12 37:17 108:23 108:24 187:1 counts 66:23 couple 7:21 25:3 29:25 38:24 48:9,15 55:9 56:7 65:5</p>	<p>198:10 204:16 coupled 80:25 course 1:6 4:16 5:22 6:22,24 7:18,21 8:23 11:14 14:25 18:25 38:1 40:3,13 41:14 42:25 46:13 53:24 56:18 57:23 61:11 67:2 76:18 83:8 86:3 94:2 95:3 99:14 112:20 116:17 118:14,16 122:3 123:14 125:7 126:11 131:22,24 132:13 133:16 140:22 146:11,22 147:11 148:17 152:13 157:17 158:16 159:20 160:15,23 164:17 165:3 166:12 168:25 169:3,17 173:10 174:20 180:9 185:23 191:22 223:20 courts 2:20 6:20 134:17 136:25 139:1 141:18 142:2 150:19 157:22 160:12 167:18 172:11 178:21 180:2,6 194:7 Court's 2:19 3:1 116:14,18 121:8,9 121:14,20,24 123:11 124:25 132:4 133:13 136:21 141:8 142:1 142:4,22 149:7 151:12 153:9,11 154:3,10 155:2 156:4,5,8,20,22 157:9 158:17 159:1 160:3 161:8,15 215:5 cover 14:7,8 170:13 170:22 171:24 covered 70:11 102:23 148:13 covering 190:23 covers 144:24 Covid 94:3 co-operation 208:24 209:22 co-operative 209:21 crack 58:4 crazy 22:16,17 create 18:13 39:25 42:16 52:3,9,17 80:21 99:7 created 16:10 31:9 45:5 80:4 creates 85:5 creating 202:15 crest 56:6 crest-gated 36:10 criteria 2:11 4:11 7:14 10:24 191:8 192:5</p>	<p>192:12 196:15,22 197:20 199:22,24 200:4,13,16,20 207:9 218:2 criterion 223:6 critical 76:2 120:3,6 120:23 122:1 critically 75:3 142:23 cross-reference 192:6 192:25 cross-referenced 150:4 193:2 Crucially 173:4 crux 143:2 crystal-clear 38:22 176:10 cubic 46:4,9 201:9 cure-all 15:1 curious 150:3 current 205:13 216:1 currently 59:15 currents 25:13 curriculum 51:7 cursor 29:1 curve 83:23 85:22 86:1,6,8,9 87:3 104:21 108:22 109:3,22 110:11 112:1 curves 87:1 88:23 89:1 104:14,16,19 108:18,19 109:6,13 109:16,17 110:13 111:10,13,14,19 cusces 165:5 customary 160:19 167:24 169:1,3 194:8 221:23 222:6 222:11,15 223:4,8 223:13 customer 99:8 customers 75:25 80:9 cut 16:12,15,21 44:14 170:15 cutter-head 45:18 46:2 cutting 2:2 cyclones 27:21</p>	<p>85:18,22 86:14 96:18 102:7,18 104:15 188:11,17 188:23 199:10 210:8,9 dam 15:2 17:23,23,23 18:8 26:2,2,4,21 28:3,4 33:24 34:5,9 34:23,24,25 35:2,5 36:3,8,9,12 39:24 39:24 40:1 41:17 42:15,17,18 45:20 45:21 46:15 53:15 55:1,17 56:4,6,17 56:22 58:7,22 61:9 201:3,8,14 214:9 215:1 damage 204:24 damaged 55:8 56:18 dams 15:5 16:15,20,21 16:25 17:5 19:14 23:21,25 52:14 54:15 60:21,25 61:4 61:12,15 dam/short 58:22 danger 21:23 55:16 Daniel 2:9 3:2 1:5,7,8 1:14,24 2:1 11:9,19 62:13 106:3 112:6 113:24 114:7 115:2 115:9 155:17 170:2 170:3 171:2 193:19 194:12 224:1,5,15 darker 68:14 97:18 Dasu 17:17,19 22:6 data 37:19,20 49:19 60:8 107:2 208:23 209:7 210:9,20 214:23 database 184:17 data-sharing 223:16 date 65:2 66:10 104:1 116:18 123:22 156:25 157:3,5 174:19 dated 116:3 127:20 141:8 day 1:6 3:1 1:7,13 71:16,16 76:24 77:1 77:8,10,12,14 81:12 82:25 85:19 86:23 87:1,1,4,5 88:8,9,17 94:16,19,24 95:1,16 95:25,25 96:9,20,25 97:7,13,13,24 101:16,17 110:4,15 110:17 111:4 114:10,17,19,23 191:22 224:2,3,17 daylight 94:17 days 7:21 23:10,10 27:22 29:23,25 40:20 102:15 196:17 198:10 200:1 204:17 212:19 221:12 daytime 87:23 95:19 96:4 98:5</p>	<p>day-by-day 91:16 de 147:19 174:7 204:13 dead 28:10 29:17 33:11 129:3 152:11 152:22 154:21 198:16,23 199:4 deal 9:6 12:22 15:3,5 15:6 16:24 18:10 19:10 32:5 48:15 50:2 76:21 78:19 85:14 88:20 101:21 104:19 106:12 205:7 dealing 16:19 76:13 97:21,24 107:2 109:7 193:3,11 199:20 deals 96:16 189:21 dealt 6:10 112:23 168:14,16 193:5 debate 10:7 144:17 debris 26:3 56:3 decade 67:8 decades 45:11 51:12 60:18 December 188:7 decide 124:9 141:6 149:8,15 179:21,22 decided 35:1 118:9 148:25 182:9 decides 179:13,20 deciding 123:11 149:18 160:16 decision 47:6 57:16 120:2 121:9,14 122:9,10,11 127:14 127:24 128:10,23 129:11,13 130:10 130:17,22 132:4,14 133:10 135:10 138:9,10,12 143:15 144:20 145:2,4,21 146:8 147:4 148:9 148:20,22 149:1 153:9,11,15 154:10 154:25 155:9 156:1 156:2,4,5,8 157:13 157:16 158:20,24 159:2,4,19 161:17 162:9 163:7 165:4,6 165:10 166:9 172:2 172:17,23 173:25 174:3,17,20 175:21 176:4,6,19 177:11 179:15,17 180:2,6 180:14,16,21 182:4 182:8,11 decisions 2:20 6:20 117:3 118:20,24 119:9,12 121:1,3,11 121:16,19 122:14 122:17 123:5 125:3 125:17 126:18 132:8 134:13 137:1 137:16 139:3,4,7,10 139:11,13,19,21 140:1,4,6,24 141:2</p>
---	---	---	---	--	--

<p>141:7 142:1,6 147:12 151:9,12 152:1 156:16 157:24 160:10 163:4 167:25 168:15,25 172:6,10 174:9,15 176:13,15 177:7 178:17,23 179:25 216:2 decision-making 214:14 decisive 176:10 declaration 151:25 152:7,8,10 decline 41:13 declined 92:20 declining 93:3,22 decrease 14:17 decreased 53:16 decree 166:25 167:1 decrees 167:10 dedicated 68:21 69:1 79:19 91:21 96:15 100:14,22 102:21 103:25 104:9 105:4 deemed 188:19 deep 29:15 33:21 36:11 178:2 deeper 34:14,14,14 36:21 defaulting 214:2 defer 95:24 105:24 113:4 deferral 96:2,6 99:15 deficiencies 38:11 deficit 85:8 define 36:3,7 73:1 74:5,20 212:13 defined 36:19,19 79:20 198:16 199:7 199:23 200:10 203:1 204:8 210:2 defines 188:6 198:3 defining 161:3 197:15 214:17 definitely 16:9 definition 75:7 134:17 184:8 189:4 205:22 definitions 102:12 definitive 125:1,15 131:8 133:24 147:21 150:20 160:25 degrade 27:9 degraded 14:11 degree 67:4 71:10 77:4 87:16 90:6 100:12 117:15 212:6 delay 115:15 deliberations 5:24 6:5 Delimitation 148:3 delimiting 217:19 deliver 47:3,3 85:16 86:16 112:10 delivered 27:18 81:6 85:25 141:14 delivers 41:6</p>	<p>delivery 75:24 delta 20:17 21:11,12 21:13,21 28:17 35:13,18,19 deluge 1:9 demand 49:14,16 64:9 64:10,14,18,21 65:10,11 70:1 71:5 71:7 72:2,11,12 73:2,10,13,19 74:15 84:10 87:16 90:19 106:14 109:19,25 109:25 110:9,19,20 110:23 111:13 210:17 demands 71:1,15 73:21 74:17 203:15 demarkation 32:23 demonstrate 84:22 demonstrates 127:10 density 18:21 80:12 deny 186:24 denying 134:2 departs 198:14 depend 79:25 221:25 depending 19:24 40:25 81:25 93:8 104:13 108:21 depends 27:19 39:23 40:1 47:16,20 96:8 101:6 109:10 depletion 152:22 deploy 40:23,24 deposit 42:8 53:12 deposited 13:17 33:2 33:4 53:18 deposition 18:22 33:1 35:14,18 deprived 156:10 Depriving 149:10 depth 89:7 Deputy 2:19 desander 35:23 37:9 212:10,11 desanders 38:5,18 describe 33:16 198:8 described 49:11 80:6 117:16 136:1 description 71:22 design 3:3 2:11 3:18 3:21 4:11,22 7:14 10:24 12:12,20 17:19 26:17 27:7 35:3 37:25 48:11,17 48:18,21 55:23,23 56:20,22 57:1 58:25 61:4,7 63:20 74:6,9 80:23 103:22 104:17 105:17 106:10 117:17,19 120:20 131:1 136:12 137:5 155:20 157:5 166:18 175:4,9,12 176:2 196:24 198:9 199:21,24 200:9,20 201:1,10,11,17 207:9 208:21 210:5</p>	<p>210:22 211:3,15,23 212:2,17 213:3,13 213:20 216:19 218:6,9,12 221:23 222:16 223:12 designed 27:5,6 56:5 120:14 162:22 166:6 197:16 211:13 designing 48:20 199:23 200:22 213:6 designs 123:2 125:13 125:19 218:14 desire 217:13 despite 108:3 131:6 destabilise 21:21 destroy 14:7,7 destroyed 55:1,1 detail 3:5 8:6,13 10:14 78:10 105:1 107:20 125:4,22 132:11 134:9 138:4,22 186:8 190:7 198:8 198:10,12 208:16 210:4 detailed 2:9 207:8 208:6 details 80:2 89:14 105:17 111:23 112:3,23 determination 5:21 6:1,15 117:23 119:5 120:13 124:1,4,5 125:18,24 126:3 129:23 130:2,25 132:21 135:21 136:15 137:19 174:21 175:22 176:1,17 178:8 181:17 214:21 determinations 131:11 134:3 161:12 168:9 determination/judg... 133:14 determinative 141:16 determine 63:19 71:14,16,24 74:14 89:4 148:14 184:16 determined 31:22 80:22 136:10 146:13 determines 77:18 88:14 92:11 101:19 develop 71:8,10 73:2 186:20 developed 96:14 97:20 103:10 108:21,23 186:10 203:22 developing 66:22 108:24 112:19 215:10 development 65:1 66:3,11 69:9 70:3 73:24 93:5 96:13 103:5 109:4,11 110:8 185:1 186:23</p>	<p>210:14 developments 65:2 203:19 214:1 develops 196:21 198:5 devices 91:2 devoted 161:22 diagram 12:17 13:14 35:9 71:21 78:6,21 79:5 83:15 89:10 91:25 98:13 193:10 diagrams 87:21 88:7 93:25 94:25 Diamer-Bhasha 17:18 17:19 22:6 dictionaries 198:15 die 48:5 died 55:2 diesel 68:4 87:19 differ 162:5 difference 28:24 29:14 67:15,18 76:16 80:11 87:9,12 118:12 171:24 173:24 176:10 180:20 193:12 208:16 differences 116:25 122:20,22 140:20 142:20 173:6 differer 25:4,5 32:21 35:8 37:11 49:8 50:20,22,22 52:10 53:14 60:15 67:20 76:15,20 79:3 81:9 81:25 85:13 87:5 89:2 92:16 102:23 106:20 108:23 111:9 112:14 137:23 138:12 155:4 172:4 178:19 184:23 185:4 192:4 192:20 199:1 200:23 202:9 205:19 differentiate 85:12 differentiation 43:24 74:12 104:4 differently 56:23 76:21 difficult 44:11 55:21 60:9 61:25 88:20 103:12 107:1 151:7 163:9 difficulties 68:19 114:6 difficulty 99:16 dilutes 30:5 dilution 180:7 dimension 31:9,23,24 dimensions 31:9 diminish 101:2 direct 73:16 79:20 167:4 184:18 190:23 191:25 direction 22:1 66:4 82:14 directly 6:19 80:25 101:13 105:14,23</p>	<p>133:8 146:15 149:17 157:20 168:25 disadvantages 35:22 43:2 51:11 disagreed 148:19 174:21 182:10 disagreement 123:3 disappeared 109:9 discerned 221:9 discharge 31:14 34:17 85:3 112:18 189:18 199:9 discharged 44:17 198:21 214:24 discharges 45:19,20 discretion 103:1 222:16 223:11 discretionary 97:16 discuss 63:12,17 170:5 170:12 discussed 26:10 38:7 102:14 105:1 153:18 222:8 discussing 69:15 168:4 170:11 discussion 7:5 11:21 12:3 23:16 46:21 128:18 158:9 discussions 19:2 48:25 118:25 122:24 188:22 204:16 dismiss 132:17 dismissed 129:7 dismisses 125:11,14 132:4 dispatch 46:25 64:4 71:15 77:16 86:12 101:20 dispatchable 98:23 dispatched 68:22,25 displace 178:7 dispositif 121:25 122:4,7 143:16,17 143:20 144:10,12 144:20 145:2,14 146:1,12,14 148:1,7 150:5,7,9,13,15 152:4,18 156:12,20 158:14 dispositifs 152:17 dispositive 6:7 132:24 dispute 117:7,13,22 118:16,22 119:12 119:15 126:16 127:1,8 131:9 135:6 135:9 137:14 140:12,13,14,15 141:22 142:17,18 142:23,25 144:5,5,9 144:13,24 146:5 149:17,18 153:21 153:23,25 169:22 171:23 172:1,5 174:18 175:4 176:11 180:20 193:11 205:14 disputed 123:11 124:9</p>	<p>144:13 disputes 116:25 124:12,14,18 126:20,21 128:1,24 140:23 142:5,19 144:5 147:8 149:9 149:13 151:13 167:11 173:22 178:18 201:22 disregard 151:8 disregards 132:21 disruption 99:7 distance 59:22 distances 53:14 distinction 118:2 136:24 distributary 41:9 distribution 80:8 91:2 94:9 diversion 151:19,24 201:16 diversity 70:21 divert 19:7 25:16 diverts 26:25 27:1 divided 46:5 197:13 division 161:1 doctrine 143:2 147:17 149:22 164:19 165:22 doctrines 126:22 151:6 document 87:12 187:21 190:10 documents 112:25 186:9 doing 6:12,18 22:21 24:16 61:9 77:9 86:23 88:21 102:17 110:2 179:11 domestic 202:25 203:2 203:5 DON 1:11 done 21:8 27:7 34:10 50:25 58:20 73:15 91:8 105:19 111:17 113:22 190:7 224:2 door 16:7 166:1,4 dots 79:5,10 dotted 39:21 doubling 23:3 doubt 50:16 153:19 158:1 159:9 224:9 down 6:6 21:15 22:14 26:24 28:2,4 29:3 29:17 30:12 32:19 33:10 38:17 39:22 40:1,11 47:7 49:25 50:8 52:11 59:3 79:2 82:15 83:2,24 84:19 85:20 93:7 94:21 95:7 100:25 109:8 110:16 202:14 203:11 downstream 16:25 17:22,22,24 18:9,15 18:25 19:3 22:10 23:19 24:20,21 27:2 30:3,8,17,22 31:3,6</p>
---	--	---	---	---	---

<p>32:25 33:3 34:7,24 35:6 40:15 41:6,19 41:22,23 42:8,17,21 42:23,24 43:18,20 45:6 46:24 47:5,8 47:13,22 48:6,7 52:4,9,17,19 53:5,9 53:16,17 55:2 56:7 59:12 62:3 80:12 202:3,15 214:6,22 215:7 dozens 218:10 Dr 1:11 2:10,13 3:5 1:15 2:4,12,13 3:16 3:23 4:7,17 11:8,16 11:19,23 12:10,14 15:10,10,12,20 16:10,11,12,14,15 17:2 19:17 20:6,16 20:21,22 21:7 23:15 24:5 32:4,10 34:2 35:13 51:24 52:10 54:19 56:25 57:22 59:9,10,15 60:20 61:7 75:11 102:15 111:12 112:24 113:6,10,11 212:24 213:2 218:15 219:2 draft 188:7 190:12,14 191:7 drafted 169:6 171:20 drafters 190:9 drafting 150:15 191:3 drafts 8:22 187:19 dragline 45:23,23,24 46:1 drainage 45:4 197:11 drains 40:5 dramatic 14:17 15:25 65:24 165:8 166:13 dramatically 65:16 67:8 92:20 draw 3:13 10:21 26:24 30:12 33:10 39:22 40:1 47:7 96:4 168:2 drawdown 6:9 23:22 25:14 27:15 28:1 30:25 39:23,24 40:8 41:16 47:17 127:24 129:2 132:25 151:20 152:6,20 153:1,6,10,19 154:11,16,21 155:12,23 156:9 157:1,11 158:12 159:14 160:2,8 161:15 165:3 175:1 177:12 178:3,4 216:5,6,20 221:20 drawdowns 29:15 drawing 29:17 39:19 drawings 11:25 12:4,6 12:7 drawn 28:4 118:2 draws 97:4 redge 23:3 45:18,22 46:3,12,12</p>	<p>dredged 45:17 dredges 45:17 dredging 13:25 22:3 22:15,15,17 23:2,14 42:12 44:20,21,25 45:12,14,15 46:4,9 46:17,22 47:9 drew 215:12 drinking 203:3 driven 112:25 drop 28:14 29:4 38:16 40:4 65:23 dry 29:2 38:19 88:8 100:3,12,19 due 6:24 8:22 11:14 97:7 131:23 146:11 169:16 188:18 223:20 Dul 42:18 duly 157:6 dump 45:25 duplicative 137:15 duration 77:20 88:23 104:21 112:1 during 3:19 4:15 27:16,18 28:10,21 29:2,4 31:7 32:25 38:17,19 39:8 68:22 77:6,11 82:3,22 83:5 84:4 88:2 95:16 97:13 99:11 99:17,23 106:1 118:25 154:21 161:24 169:12 187:11 201:1,4 duty 137:12,17 160:12 160:14 215:21 dynamically 106:19</p> <p style="text-align: center;">E</p> <p>e 178:6 184:12 189:23 191:13,15 192:4,7,9 192:16,21,25 193:11,17 196:12 197:23 198:19 200:23,25 205:12 205:17,22 206:3 212:20 219:18 220:6,10 each 3:6 70:17 71:13 72:23 74:22 81:12 87:4 89:5 92:3,4,8 121:19 127:8,16 138:25 139:6,6,7,23 141:15 151:4 187:1 200:16 203:11 204:23 208:11,17 211:3 217:20 218:4 earlier 80:6 119:5 120:13 126:7 132:3 138:1 148:20 152:24 157:13 158:18 172:2 176:20 178:8,14 181:21 201:11 206:2,8 219:17 earliest 66:3 early 13:1,1 66:10</p>	<p>67:13 70:2 73:24 186:14 211:8 214:14 219:12 earthen 39:24 earthquake 15:23 21:4,18 Earthquakes 16:3 ease 139:9 easier 57:20 easily 16:6 91:8 eastern 69:22 161:7 185:25 186:23 189:13 easy 144:1 ecological 47:24 economic 72:4 73:4 93:5 economical 213:12 eco-flow 107:12,13 Edison 66:4 educating 182:17 effect 2:20,25 6:20,23 7:8,14 87:1 112:4 119:12 123:8,15 126:13 129:9 130:9 130:25 133:15,20 134:2 136:23 139:2 139:3 140:1 142:6 143:22 145:16,21 146:16 155:2,5,25 156:5,11,16,22 157:13,24 158:5,11 161:11 162:15,19 163:23 166:1 174:1 175:21 176:1,12,14 176:18,20 177:6,6 177:24 178:15 180:8 181:17 196:25 203:25 209:13 effective 64:4 126:20 147:10 151:3 216:7 effectively 16:12,21 75:9 99:18 108:4 116:24 138:25 161:16 172:21 186:22 effectiveness 150:22 effects 138:8 214:6 effet 194:17 efficiencies 80:14 efficiency 38:2 65:14 83:15,17,20,23 efficient 126:20 eggs 48:3,4,5 Egypt 19:19 EIA 214:7,10,13,18 215:15 EIAs 216:2 eight 77:8 88:12 either 17:22 30:1 32:7 33:16,16 57:24 58:15 65:6 79:20 110:5 162:7 164:25 165:19 166:11,14 198:15 208:22 209:2 elaborate 116:11</p>	<p>171:16 elect 19:24 electric 65:13,16 109:23 110:2 electrical 64:25 65:10 80:7,13,15,16,18,21 91:2 109:20 electricity 63:15 64:12 64:21 65:7,18 66:6 66:8 70:3 80:4 91:6 91:9 electronics 11:20 elements 131:1 139:23 176:2 elevation 25:23,24 32:17 34:14,19 61:24 eliminated 21:24 elongates 41:14 elsewhere 121:25 166:20 168:6,14,16 Embassy 2:7,8 embodied 8:15 emerge 109:25 emergency 129:4 152:13,16 198:22 199:19 205:5 eminent 134:14 emphasis 184:24 emphasise 10:24 170:14 207:4 emphasised 118:6 152:24 153:10 155:10 156:1 188:13 215:14 emphasising 189:18 190:17 employ 152:20 employed 28:7 34:1 empty 6:9 28:16,17 30:11,13 40:9,15 218:15 empyting 47:11 enable 64:3 78:23 207:20 encapsulate 150:14 encourage 73:17 end 11:5 26:23 29:8 34:7 39:2 40:13 43:13 65:15 114:16 114:19,23 147:10 147:25 149:9 163:16 180:23 200:15 217:13 224:3 endeavour 10:21 endeavouring 4:14 endeavours 204:4 ends 50:17 end-user 94:8 end-users 72:18 energies 67:7 70:22 100:15 engage 4:5 135:4,13 engaged 191:1 engaging 142:25 209:15 engineer 4:12 5:14</p>	<p>12:6 58:17,25 134:25 160:16 173:11 engineering 3:4 4:20 12:13 57:3 76:17 134:20 173:7 198:15 199:2 209:2 212:25 213:8 216:25 engineers 43:23 44:2 213:3,18 English 50:11 enhanced 201:4 enormous 157:16 enough 9:18 14:12 31:19 72:12 88:10 99:6,21 enquiry 19:17 ensure 3:10 78:2 204:11 ensures 197:21 ensuring 117:1 162:3 203:18 entail 152:22 enter 86:14 223:8 entered 166:25 167:10 enters 41:5 entire 21:21 28:11 34:18 60:2 85:14 97:24 143:15 entirely 23:17 67:20 191:16 213:9 220:8 entitled 178:1 187:18 197:5 204:2 entitlement 10:5 187:16,20,22 207:19 entity 55:21 enuniciated 159:7 environment 14:23 40:25 47:20,21,23 48:12 environmental 5:11 44:8 54:17 97:8 103:14 166:21 214:5,25 215:9,22 222:8 environmets 54:11 envisaged 66:12 189:19 190:12 equal 89:6,7 equally 141:9 147:8 163:19 equation 24:17 43:7 equilibrium 36:4 39:11 equipment 22:25 82:2 104:13 107:5 equitable 49:25 166:25 167:10 equivalent 18:21 31:13 46:11 160:23 167:4,5 185:14 erga 129:9 erosion 13:23 14:8,10 16:10 17:21 errors 136:4 especially 47:21 48:14</p>	<p>49:9 63:6 87:17 90:1,19 93:3 99:2 126:14 essence 74:14 essential 78:9 127:1 147:5 150:21,24 155:15,18 157:14 essentially 21:23 31:20 52:2 119:11 120:21 147:16 Essex 2:9,10 establish 36:9 39:11 209:21 established 39:12 106:12 119:13 140:18 establishes 74:16 establishing 75:5 estimate 73:2,3 et 14:1 18:22 26:17 31:15 41:3 45:9 48:7 62:1,5 135:17 etc 188:19 Europe 110:13 evaluate 214:6 evaluation 73:5 evapotranspiration 49:15 even 17:18 38:19 46:19,20 49:25 58:1 60:13 80:1 81:2,21 82:17 87:21 90:3 94:13,18 95:6 100:19 120:13 126:11,20,21 132:13 142:9 147:11 176:16 192:11 201:19 207:23 209:8,12 223:15 evening 1:11 68:22 77:6 97:2,7,11,14 97:22 98:5 event 20:23 21:3 26:3 27:17 30:22 40:14 45:5 55:3,3 56:5,10 56:17 162:10,24 165:18 166:7 169:1 170:1 194:10 events 27:19,24 28:21 29:11 32:25 40:21 61:22 163:13 eventually 105:21 187:9 ever 2:8 evermore 7:11 8:1 every 8:7 57:4 78:10 84:8 86:23 87:5,5 89:19 111:24 139:16 213:14 everybody 18:17 46:17 everyone 1:3 115:15 220:24 everything 79:6 everywhere 61:15 103:7 evidence 20:24 194:5</p>
---	---	--	--	--	--

<p>214:20 evident 65:21 evidential 3:10 8:6 evolution 20:25 63:5 63:25 92:2 106:9 111:18 evolved 66:7 evolving 107:16 111:23 exact 59:2,21 exactly 3:12 17:13 33:8 49:11 111:2 113:22 163:9 192:24 examination 151:15 Examining 140:3 example 24:8,9 25:20 26:19 27:10 36:10 36:22 39:1 43:21 46:18 56:22 69:16 71:5 78:24 90:14 107:5 132:24 145:23 146:1 149:5 153:4 161:14 167:25 184:24 185:20 188:17 202:12 213:12 221:18 222:6 examples 150:3,10 189:2 218:8 exceed 90:11 exceeds 189:1 Excellent 224:14 except 36:13 129:3 141:4 152:12 159:1 184:11 186:3 196:11,22 198:6 200:14 205:17 excepting 190:19 exception 8:18 10:9,11 10:13,15,17 123:15 156:13,21 158:5,12 158:13 162:13,16 162:17,20,22 163:25 164:11 166:5 183:8 187:10 187:20,23 188:1 193:9 194:2,20,21 194:24 195:5,18 196:2,11 197:10 202:23 204:9 205:18 218:18 exceptions 9:5,13 10:1 10:2,4 156:15 157:8 157:21 183:8,24 193:15 194:8 195:7 195:8 196:13 202:22 217:6 218:21 excess 41:8 excessive 14:6 exchange 8:21 217:23 exchanges 5:4 9:15 98:14,16 excluded 158:6 excludes 195:14 excluding 20:19 38:2 exclusive 32:7 123:11</p>	<p>183:23 186:22 Excuse 206:8 executing 204:22 exempted 44:13,13,19 exercise 71:23 116:22 135:15 137:13 159:15,16,17 175:4 exercised 159:19 160:4 Exhibit 112:16 131:20 217:12 existence 140:17 existing 61:12 exists 73:19 137:9 expanded 20:19 expansion 63:18 71:23 73:8 74:13,18 expansive 217:5 expect 7:19 52:12 59:6 66:21 102:1 109:13 114:11 145:12 221:10 expectations 73:6 expected 90:11 168:1 208:4 expensive 22:18 experience 4:19,22 experiments 30:23 53:13 expert 5:14 7:5 113:1 116:21,23 117:10 117:15 118:1,6,12 118:19 119:6,8,10 120:13,20 121:1,11 121:14 124:15,16 125:3,16,18 126:25 128:6,13 129:7,20 130:3 131:2 134:13 134:24 135:4,12 136:22 137:7,20 138:2,10,15 139:4 139:12,21 142:3 151:8 156:7 159:20 159:24 160:16 161:13 163:17,19 167:19 168:9,15 169:19,21 172:6,17 172:24 173:6,10,14 173:17,22,25 174:6 174:10,15,19 176:3 176:15 177:7,11 178:24 179:3,13,17 179:20 180:1,15,22 181:5,10,22 expertise 134:20 experts 2:21 5:5 6:21 124:8 136:25 157:25 160:6,24 172:10,12 178:21 178:22 expert's 5:21 6:14 129:11,13 130:22 130:25 174:24 176:1 177:25 178:8 explain 35:10 63:2 109:12 119:25 120:15 126:22 136:20 142:7</p>	<p>169:16 196:17 explained 46:19 140:4 149:3 154:14 161:17 175:20 201:14 213:3 218:16 explicit 128:16 142:14 144:25 158:13 161:16 167:8 explicitly 126:5 136:9 140:7 141:23 142:8 163:13 164:22 168:22 176:22 express 154:5,7 158:25 186:10 192:5 expressed 81:15,16 209:19 expresses 10:11 186:15 expression 50:13 expressly 6:13 132:17 133:13 134:7 193:2 193:23 194:1 195:5 195:18 197:8,9 206:25 extend 144:5,10,19 164:20 extended 70:8 95:15 128:25 135:15 198:20 extending 163:23 extends 173:22 extensive 21:8 extent 3:2 23:23 95:15 100:2 121:10 144:8 144:18 145:1 150:5 152:21 156:15 164:15 172:23 181:9,25 191:17 203:24 204:10 211:23 212:4 222:12 extra 36:20 extract 203:23 204:2 extracts 131:25 extraneous 212:21 extraordinary 56:17 extreme 29:11 58:15 58:15 extremely 72:21 106:16</p> <hr/> <p style="text-align: center;">F</p> <p>f 124:17 135:7 160:23 172:15 173:9,13,20 173:24 174:5 179:14 180:10 212:20 face 21:13 35:23 140:20 152:7 195:5 faced 45:10 148:17 153:25 214:19 faces 17:12 facilitate 137:14 facilities 79:16 91:1 100:5 facility 11:25 210:16</p>	<p>facing 13:1 153:5 fact 5:2 54:21 97:12 121:21 122:1 134:4 136:16 137:20 140:17,21 141:22 144:6,14 145:24 146:7 147:21 154:14 155:18 169:1 170:17 173:9 174:8 factor 14:9 47:5 88:14 105:2 196:7 216:19 factors 47:5 57:5 78:12 105:20 162:6 164:10 124 166:10 175:5 195:2 213:15 213:16,16 factual 122:15 146:2 fail 18:8 76:19 fair 113:25 170:6 fairly 101:18 faith 151:6,8 194:16 fall 174:10 191:11 219:22 falling 99:10 121:19 172:13 173:7 179:14 223:12 falls 61:8 82:11 169:22 172:1,24 173:24 222:12 familiar 118:14 119:19 146:23 far 27:11 45:13 54:14 122:17 125:23 126:12 133:3,11 135:10,17 204:23 farm 90:10 farms 14:18 fascinating 57:4 fast 166:17 faster 95:8 fastest 89:18 fast-reacting 95:5 fatally 146:9 FATIMA 2:7 favour 73:16 110:15 feasibility 74:1 feasible 24:11 46:17 46:18 216:11 features 47:17 218:9 February 7:2 123:19 130:8,21 131:13 fed 5:8 federal 44:4 feel 4:2 8:7 115:3 169:13 feeling 170:7,8 felt 167:7 few 51:25 70:24 77:6 79:10 102:25 115:14 122:19 138:17,18 143:13 191:14 198:11 fewer 57:14,18 103:17 field 5:15 41:2 51:15 136:12 Fietta 2:11,11,12,12 2:13 3:16 2:17,19</p>	<p>2:23 5:17 6:17 8:11 114:11 115:4,16,17 115:19,25 131:22 132:10 133:18 143:10,25 145:11 146:18 149:25 150:12,18 158:4,9 163:20 164:13 166:3 167:4,13 168:12 170:6,12 171:7,8 179:9,24 180:13 181:1,8,15 181:24 182:3,15 200:6 Fietta's 5:17 6:22 fifth 196:17 222:14 223:11 figure 38:1 66:17 67:11,21,22 68:1,4 68:7,10 69:23 92:19 95:7 97:23 111:16 111:17 figures 67:23 94:22 file 113:16 fill 17:19 38:24 41:24 41:24 87:20,22 88:10 95:17 97:2 filled 26:4 29:2 fills 120:2 filter 41:22 filters 98:10 final 63:25 69:11 121:12 123:7 129:11 131:8 134:9 140:12,25 141:20 142:16,21 144:3,4,9 144:23 145:20 146:3 147:4 151:8 151:23 156:16 157:24 158:11 161:20,23 162:1 163:14 167:8 168:7 168:12,14 172:11 172:18 174:16 179:22 181:6,13,16 188:12,23 finality 148:9 finally 10:20 43:16 103:21 142:17 183:20 205:6 financial 72:1 91:22 find 10:12,13 19:12,12 32:6 55:14,20 78:5 89:10 103:11 109:2 finding 129:9 findings 6:7 145:24 146:2,7 155:3 160:25 173:18,18 fine 36:16 106:7 113:18 114:7 143:12 158:4 170:23 207:3 finer 112:3 finger 17:13 fingers 44:11 finish 131:13 finite 19:25 124:11 firm 73:9,10,20,21</p>	<p>74:11,11,17,18,20 74:20,22,23,24,24 75:4,6,7,12,23,25 76:6,8,22 77:15,18 77:20 89:8 93:13,13 104:24 first 1:7 2:7,8 6:24 7:23 20:23 24:10 52:1 53:7,8 59:10 59:17 65:1 67:23 76:17 116:15 118:13 119:7,17 120:8 123:6 125:6 126:11 127:19 130:13 139:1,19,25 140:3 151:23 157:8 160:11 162:15,20 176:24 183:13 184:2 185:8 186:12 186:19 187:19 194:5 195:4 200:24 203:2 214:4 217:16 221:15 firstly 63:13 64:5 fish 40:16 44:8 48:3 Fisheries 44:7 fit 5:7 89:10 97:2 fits 122:9 Fitzmaurice/Waldock 10:7 five 69:21 134:18 195:2 197:13 221:13 fix 212:11 fixed 32:14 66:6 219:6 fixing 217:19 flagged 193:19 flat 25:12 flattens 21:13 flatter 109:4 111:20 flawed 6:2 flexibility 87:18 103:11,13 212:6 flip 18:3,7 84:9 flipping 84:12 flood 27:16,18 28:3,4 28:22 32:25 39:8 46:16 52:17,20,21 53:23 54:25 61:14 199:19 202:15 204:18,18,22,23 205:3,3 224:10 flooding 54:3 61:15 floodplain 18:23,23 floodplains 31:15 floods 30:4 32:1 52:16 flood-control 52:18 floor 1:7 82:3 94:5 flopping 40:17 flow 9:3,12 16:22 26:3 31:10,20 32:25 33:6 38:17 48:2 53:4,25 53:25 56:3 75:5 76:24 81:2,4,6,10 81:24 82:15,17 83:16,19 84:16,18 87:25 88:2,16 96:8 101:13 108:3,11,15</p>
---	---	---	--	--	--

<p>108:16 162:9 165:3 165:5,13 166:8,10 166:21 183:4 184:4 184:6,14,20,22 185:3,5,8,11,15,18 185:21,22 186:5 187:25 188:11,17 188:23,25 190:19 192:2 193:13 202:3 202:7,16 211:18 214:22 flowing 28:20 189:3 flows 23:24 26:12 31:7 31:11,22,24 42:16 42:20,23 123:10 161:23 162:4 214:24 215:2,7 fluctuate 29:3 fluctuations 94:18 101:11 112:10 188:17 199:9 flush 23:9 24:21,23 30:8 31:24 39:19 42:4,5,7 47:6 flushes 30:13 flushing 6:9,9 13:25 23:8,22 24:10,13,16 24:19 25:2 28:24 29:10,10,15 30:21 30:23 31:4,17,19 32:7,12,14,16,23 33:1,5,6,8,12,14,22 34:16,18 35:1 39:19 40:10,13,21 41:12 41:14 42:4,16 43:4 43:15,19,25 44:20 44:23 45:5 46:22 47:11,22 50:15 51:10 127:25 132:25 151:20 152:6,21 153:1,6,10 153:20 154:11,16 154:21 155:12,23 156:9 157:1,11 158:12 159:14 160:2,8 161:15 165:4 175:1 177:12 178:3,4 216:5,6,20 218:15 221:20 focus 1:19 2:8 5:9 8:12 15:7 92:9 164:14 169:7 218:15 221:3 focused 24:16 50:4 219:2 focuses 14:4 focusing 4:23 18:11 33:2 50:11 folders 116:6 follow 75:14 78:14 84:1,16 95:10 followed 2:13,23 11:14 72:6 following 2:12 4:17 5:16 8:11 19:17 32:11 99:4 126:14 127:17 130:20,24 149:21 177:15 201:6 203:16</p>	<p>221:13 224:17 follows 44:18 142:3 follow-up 41:2 220:18 fora 117:2 138:13 forced 34:25 forecast 72:3,4,13 73:11,13,19 74:15 Foreign 2:5 forgo 24:12 forgone 46:23 form 111:8 120:2 141:7,15,19 145:19 184:15 formal 141:11 211:12 formally 162:17 format 4:4 formed 155:14 158:14 forming 140:23 forms 161:18 formula 75:4 forth 206:20 fortnight 202:14 forward 77:24 103:19 129:19 161:16 179:10 190:25 forward-looking 162:22 fossil 23:12 found 26:14 75:25 169:15 184:18 foundation 1:19 2:9 4:12 four 12:17 13:15 52:24 63:12 77:7 87:6,13 121:19 127:15 138:8,10,12 138:13 141:14 183:12 185:6 fourth 156:19 196:7 222:9 framed 134:7 185:11 framework 212:5 213:1,10,11 216:12 217:1 218:25 Francis 83:15 free 4:2 169:13 freeboard 124:20 192:22 freedom 110:21 frequency 54:12 66:6 78:14 80:21,22 81:22 82:24 83:3,25 84:17 86:18 100:25 108:13 frequent 94:20 frequently 84:20 fresh 142:25 Friday 8:10 113:10 150:2 199:7 friendship 217:20 front 21:14 56:8,12 65:21 fuel 23:12 78:23 91:10 93:21 fuels 65:22 67:3,5,25 68:2,7 72:7 91:10 94:1 fulfil 104:20</p>	<p>full 34:20 40:4 49:12 84:4 199:12,18 215:3 fully 9:7 39:13 70:12 87:10 179:10 full-loaded 88:6 fulsome 123:2 function 80:14 81:9 83:10,22 104:23 149:7 functionality 7:12 functions 81:22 116:22 209:20 fundamental 166:8 fundamentally 66:8 100:8 148:19 further 5:14 62:7 102:13 107:11 113:19 131:8 177:9 179:5 182:17 214:23 223:23 future 2:21 12:22 16:24 106:13 128:1 129:5 138:3,15 142:21 153:2,7 154:17,22 155:16 156:7 162:4,8 163:5 165:7 172:22 178:10,21,21 180:1 208:24</p> <p style="text-align: center;">G</p> <p>G 1:1 122:12 140:8,12 141:3 142:6 160:22 167:21 223:6 Gandaki 36:23 37:6 gaps 120:2 GARTH 2:19 gas 68:3 79:14 87:19 91:11 93:19,23 97:17 103:24 gate 30:15,16 222:2 gated 124:21 gates 27:16 28:3,8 30:10,13 32:15,16 32:16,19 40:16 42:1 52:15,17 56:8 82:10 82:12 108:9,11 212:8 gateway 169:4 223:8 gathering 168:5 210:19 gathering-together 222:22 gave 178:13 gear 82:5 general 2:6,19 26:8 57:19,25 59:4 63:3 63:9,14,17 64:6 66:13 69:24 71:18 93:5 117:24 118:3 126:12,17 128:1 129:5 130:15 132:23 136:22 137:12,17,24 143:6 143:7 146:19 149:11 152:6,8,9 153:1,20,23 154:1,4</p>	<p>154:15 156:21 158:18 159:18,21 160:3 161:10 162:19 173:15,17 176:7 177:22 194:13 202:1 generally 15:15 54:18 56:22 72:4 73:25 77:7 83:12 89:20 90:22 93:10 128:24 130:19 135:8 142:2 151:13 159:2 165:12 generate 15:21 21:18 42:20,23 88:3 100:10 187:18 197:5 218:1 generated 68:8 69:3 76:23 77:17 91:9 generating 16:5 23:1 71:15 79:16 81:4 generation 15:16 63:6 63:15,18 65:13,16 66:16,25 67:1,16 68:10 71:23 73:8 74:4,13,18 75:8 79:3 83:5 84:21 87:19 88:19,21 89:3 89:12,18 90:1,4,7 90:12,13 91:3,4,7 92:12 94:14,16 95:4 97:15 100:7 104:12 109:1 111:25 183:10 187:14,25 195:18,21,24 196:20 197:19 201:4 generations 65:8 generator 80:7,15,19 80:20,23,25 81:1 82:24,25 108:14 generic 134:23 137:2 152:20 153:9 154:9 155:2,11,25 158:10 158:13 159:16 161:15 Genocide 149:4 geographic 69:24 geologic 62:5 geological 60:7 213:16 geology 17:4,6 19:15 geomorphically 31:13 geopolitical 94:3 Georgina 1:23 geothermal 89:22 92:4 germane 146:15 gets 29:2 30:10 34:15 34:15 37:8 48:4 49:4,5 89:13 97:23 108:8 getting 1:18 2:8 16:16 18:12 107:8 146:10 Ghazi-Barotha 22:7 gigawatt 81:15 gigawatts 81:17 give 1:16 2:5 11:12 15:15 24:7 34:7</p>	<p>71:19,21 91:24 110:21 114:4,9 184:24 191:25 210:15 215:3 223:1 given 5:20,25 16:23,23 20:23 34:22 49:22 58:11,18,18 74:16 76:24 81:6 92:21 98:20 120:17 161:5 161:8 163:1 168:1 168:20 181:12 189:2 190:15 221:8 gives 30:7 31:23 32:2 46:5 71:21 188:24 212:6 giving 19:16 43:21 86:5 133:15 170:19 global 63:14 65:7,11 65:19 globally 64:14 69:4 GLOF 54:24 61:22 GLOFs 54:10,14 56:23 go 10:2 16:18 17:22,22 23:4 25:2 32:3 34:14,14,25 37:3 38:6 40:11 46:14,15 51:5 53:6,11 56:13 57:18 64:5 70:2 72:8,10 73:4 84:8 96:19 102:13 103:19 111:19,24 113:7 115:4,21 116:7 122:6 130:10 132:12 133:4 142:11 143:11 147:23 152:9 164:15 167:25 170:6 177:9 179:16 180:22 185:10 186:8 190:6 199:25 207:10 213:24 220:24 goes 4:22 8:21 10:17 19:4 21:14 38:16 44:5 45:25 46:22 53:18 71:22 72:14 82:14 107:24 108:18 110:10 135:10 157:20 175:7 198:8 going 7:24,25 8:4 9:15 14:21 15:7,14 17:21 17:22,24 18:3,16 19:10,11,13 20:13 20:19 21:5 22:2 24:23,24 28:18 29:24 30:15 31:16 31:25 34:16 35:23 36:1,4 40:15,16 41:16,22 42:7,9 43:15 44:7 46:14,15 47:19 48:19,22 49:12 50:1 53:1,17 58:10 61:12,15,20 62:24 63:12 64:21 67:14 74:19 77:24 79:1,2,5 82:15</p>	<p>86:16 100:8,14 101:8,24 102:4,17 102:18 108:11 110:18 111:11 127:15 131:23 138:18,20 139:5,14 139:25 156:13 163:17 164:5 183:15,25,25 186:8 190:6 195:14 197:7 198:9 199:25 207:10 208:11 gold 96:24 gone 18:7 55:2 58:7 139:23 125:23 126:12 good 1:3,3 11:9 12:9 12:14 24:9 26:14 37:14,18 55:6 57:23 58:10,16 60:5 62:6 94:16 98:21 109:15 115:10,15 115:20 151:6,8 161:14 194:16 223:17 goodwill 217:19 219:10 Gorges 39:2 governed 128:14 191:18 192:9,17 governing 149:12 159:6 168:21 government 55:19 governor 81:21,22,24 82:6,11,16,18 83:13 83:23 84:16 107:6 108:6 governors 108:1 gradual 67:9 gradually 40:11 grandparents 65:5 graphic 43:6 grateful 224:6 gravel 26:25 43:11 48:4,4 gravels 35:20 46:2,3 48:2 gravity 80:13 grazing 14:6 great 16:24 79:11 160:2 greater 8:13 77:4 93:11,14 101:8 198:12 greatly 14:8 53:25 green 67:11 97:19 139:10 GREGORY 2:13 grid 5:7 37:14,16 70:4 70:5,6,9 78:4 80:8 90:22 98:9 109:6,11 grids 69:21,22,24 70:13,17 71:3,13 grossly 72:25 ground 40:17 170:22 grounding 63:9 group 109:7 growing 65:23 89:18</p>
---	---	--	--	--	--

<p>grown 65:10,19 67:2,7 growth 63:15 64:8,17 65:20,24 66:15,17 66:22 67:3,7,9 69:4 72:4 guaranteed 148:10 190:18 guarantees 183:23 guess 33:18 144:1 guidance 43:22 guideline 126:3 129:15,19,24 130:6 136:15 guillotine 114:23 Gujarat 90:16 Gulland 1:23 Gurez 215:1 GW 69:10 86:9,21 90:15</p> <hr/> <p style="text-align: center;">H</p> <p>Hague 1:5 half 27:22 30:1 37:5 43:12 51:1 58:2 HAMDIA 2:7 hand 33:1 182:18 183:1,6 189:14 handful 184:23 186:9 handles 38:25 handout 138:23 183:18 208:10 happen 19:13 38:4 44:3 happened 166:12 happening 85:5 109:24 133:6 happens 16:25 20:22 23:8 25:4 30:16 33:9 happy 113:15 219:11 hard 78:8 82:5 97:22 166:17 harm 52:4,9 215:22 harness 217:8 having 23:25 42:10 43:16 44:19 46:11 94:12 148:25 155:22 157:6 182:10 192:4 204:16 hazards 202:15 head 34:8 47:18 80:11 81:4 217:4 headline 10:12 heads 187:15 190:12 heaps 91:9 hear 1:20 2:10 3:8 heard 3:7,19 178:15 181:21 187:8 198:19 208:5 211:5 218:7 hearing 1:7 1:17 2:6 3:7 5:3 18:12 104:22 177:17 199:25 222:21 224:17 heart 218:23 heat 49:14 111:8</p>	<p>heater 110:24 111:3,7 heavily 7:22 8:3 103:14 196:18 held 127:6 128:12 155:13 189:24 191:2 help 31:3 42:6 113:16 122:8 helpful 11:10 35:11 56:22 59:7 62:9 107:23 113:21 169:17 192:15 222:25 223:25 helps 15:20 HEP 3:9 6:16 62:20 124:4 125:19 131:18 135:6,11 137:6 157:14 175:12,16,21 176:3 178:1,9 218:9 HEPs 2:14 3:22 4:22 4:24 5:1 117:20 120:14 123:10,17 123:20 124:6 126:3 128:2,17 129:5,25 151:13,21 153:2 155:12,16,20,20,22 156:24 157:2,18 158:1 159:14 166:19 178:4,10 her 8:24 114:14 172:24 174:3,4 herself 186:22 high 14:2,21 21:16 28:22 29:24 31:7 37:23 40:3 48:17,19 48:20 58:22 163:4 164:21 213:3,6 higher 26:22 31:11 34:19 61:21 77:13 88:11 94:8 highlight 184:1 186:9 190:8 198:11 highlighted 66:9 128:22 148:12 156:20 176:24 highly 134:25 173:10 high-flow 201:2 high-level 116:13 him 4:1,2,3,6 75:14 130:16 174:3 Himalaya 3:22 14:2 14:21,24 17:21 26:14 27:14,23 28:6 35:15,16 46:20 48:14 50:16 55:4 Himalayan 3:3 12:12 38:21 Himalayas 15:13,17 32:5 54:11 60:25 himself 135:13 historic 162:6 historical 49:19 66:25 historically 12:19,24 67:3 70:2 history 65:1 113:8 160:1 hit 41:11</p>	<p>hold 152:13 holding 28:13 158:12 158:14 161:9,15 177:12 holdings 120:5 125:1 136:21 144:11 152:20 158:17 holistically 221:5 home 111:3 honest 87:11 101:25 102:24 honour 105:15 hope 1:8 50:9 92:19 113:11 115:20 224:7 hopefully 65:8 171:1 hoping 114:9 horizon 111:15 horizontally 89:5 host 89:22 hot 111:6 hot-water 110:24 111:3,7 hour 22:20 92:23,24 93:2 113:22 170:25 hourly 87:16 hours 19:20 68:22 75:19 77:1,6,8,18 78:20 81:15,16 85:19 86:5 88:12 94:17 95:3 98:5 101:19 111:4 house 94:23 household 75:18 203:4 household-scale 90:10 huge 51:15 114:15 human 65:1 Humphrey 193:19 196:3 hundredfold 14:10 hundreds 90:9 hybrid 106:23 hybridisation 98:18 98:25 hydraulic 19:18 30:7 36:6 38:5 108:7 hydraulics 51:6 hydro 3:24 2:25 8:14 8:16 55:15 67:9 68:14 79:25 84:24 94:14 95:8,9,22 97:3 99:17 100:6,9 100:19 102:1 104:5 106:22 107:5,6,14 182:21,24 186:10 189:10 192:3 197:4 200:2,14 202:18 205:14 207:25 210:3 217:3 219:4 hydroelectric 8:19 9:13 10:9 63:21 83:10 136:13 183:10,15 187:3,14 187:25 190:13,16 191:8,18 192:17 195:17,21,24 196:2 196:19 197:3,5,22</p>	<p>202:1,13 211:7 212:10 218:7 220:11 221:22 222:17 hydrological 97:8 hydrology 27:19 42:24 47:16 50:4,5 61:3 75:21 81:7 91:21 96:8 98:7 100:18 104:24 208:23 219:3 hydropower 5:6 22:22 39:3 57:12 62:25 63:3,8,10 65:19 66:11 69:16 70:25 72:8 75:19 76:3,13 76:22 79:4,23 80:3 81:3,21 83:6,12 84:3 85:1 87:17,24 90:1,12,14 91:13,13 92:5,25 93:4,8,11 95:17,21 96:14 97:5 98:21 99:1,11,14 100:1 101:21 102:16 103:9 105:3 213:8 hydros 102:9 hydro-electric 186:21 187:18 200:10 217:9 hydro-solar 98:24 H.E 2:6</p> <hr/> <p style="text-align: center;">I</p> <p>ICIW 122:25 ICJ 148:2 149:3,18,21 168:2 idea 22:16,17 24:7 59:4 70:18 110:15 194:2 ideal 19:1 Ideally 20:6 83:19 ideas 106:20 identical 120:21 identically 87:5 identification 72:2 identified 72:9 74:2,8 124:12 162:14 211:8 identify 122:10 identifying 164:12 iii 2:25 8:19 9:8,9 135:20 183:13,14 183:22 185:7 189:5 189:7 193:7,15 194:22,23 195:6 196:2,9 197:2 202:5 202:22 205:2 217:4 217:5,6 218:19 III(2) 186:1 197:9 218:21 III(2)(a) 202:25 III(2)(b) 204:7 III(2)(c) 205:6 III(2)(d) 195:18 III(4) 189:21 196:8 205:15 II(1) 185:2</p>	<p>ILC 193:23 illustrate 64:8 67:14 78:6 illustrated 41:5 63:22 67:10 90:2 104:14 200:21 illustrates 94:15 illustration 77:22 87:1 illustrative 156:18 imagine 30:12 34:5 52:22 86:23 108:20 163:10 165:16 immediate 223:20 immediately 114:10 impact 54:14 60:4,5 60:16 145:16 200:20 214:5 215:18 impacted 53:8 54:22 54:24 impacts 43:20 46:24 49:10,12 53:9 214:23 impaired 38:1 impeded 185:21 implement 69:8 implementation 69:10 implementing 13:8 implications 24:19,20 210:19 implied 139:17 importance 120:3,6 162:2 163:1 169:8 189:5 190:5 209:11 important 16:8,9 21:25 30:2 35:25 36:18 64:2 67:6,17 67:17 68:16 70:20 74:12 75:1 77:9,24 81:19 83:8,10 84:23 88:13 90:18 94:2 95:22 100:7,18 104:3 105:2 121:6 125:21 151:3 157:10 160:9 164:11,19 173:21 174:2 192:10 208:18 209:16 214:8 importantly 94:10 127:25 161:8 173:12 175:15 imports 98:13 imposed 175:14 200:11 imposes 202:11 208:25 imposing 9:24 impounding 20:11 205:25 imprecisions 112:2 improvements 14:14 65:14 90:22 93:7 improves 90:23 improving 98:11 185:3 inadequate 214:8 inappropriate 160:15</p>	<p>incentivise 110:3 incentivising 79:21 incidental 188:16 189:2 include 78:12 84:21 89:21 145:9 146:12 191:6 214:15 included 94:10 104:7 105:20 135:21 160:11 184:22 193:23 includes 70:9 72:2 117:23 including 4:6 44:7 54:11 56:10 114:15 120:10 125:12 136:15 141:19 142:2 157:25 164:9 164:25 166:18 172:21 180:14 183:8 212:18 213:8 214:25 218:14 inclusion 154:5 158:25 incompatible 118:21 118:24 inconsistent 6:3 117:3 119:9 136:18 137:1 145:17 201:18 incorporate 27:12 197:22,24 215:2 incorporated 3:3 incorporating 3:9 2:14 5:1 62:20 increase 14:10 44:16 49:13 54:12,16 82:13 84:9 93:4 98:9 109:3 increased 35:23 increasing 49:14 66:19,20 67:11 93:12 103:5 203:15 incumbent 160:18 indeed 6:25 118:23 150:12 213:10 independence 186:24 independent 73:17 81:6 Indian 7:4 54:20,21 69:13 120:14 123:1 123:10,17,20 126:3 128:8 129:18 131:4 138:3 151:13,21 154:23 155:12 156:24 157:2 158:2 159:14 175:10 178:4,10 211:7 215:25 218:9 India's 9:2 109:14 117:19 123:2 125:23 126:8,14 127:12 130:20,22 131:15 132:11,16 133:9 134:6 136:16 154:18 155:8,9 176:25 177:21 187:13 190:12,14 194:19 195:8</p>
--	--	---	--	--	--

<p>196:18 200:16 201:9 205:9 208:14 210:5 211:17 214:7 indicate 145:12,18 166:22 168:23 indicated 39:12 79:24 128:25 131:12 147:2 152:10 153:16 163:13,25 206:9 indicates 139:10,11,13 144:21 indicating 26:3 36:2 45:20 117:11 indication 154:25 indigenous 45:8 individual 74:21 76:9 104:17 124:13 134:25 individuals 134:19 indulgence 224:6 Indus 1:2 2:4 7:3,12 16:10 17:15 18:12 19:3 22:5 41:9 66:10 67:13 69:15 70:10 71:11 75:3 102:12 118:25 127:4,16 149:16 150:25 168:22 184:19 190:22 208:9 209:17 industrial 64:15 70:5 203:5,10,15,17,23 204:3 215:17 industrialising 66:21 industries 186:13 203:7 industry 98:17 106:16 inertia 95:10 99:3,4,6 99:10 100:25 inevitable 106:13 120:24 inevitably 131:17 inextricable 195:23 inextricably 208:19 infeasible 43:20 inflow 85:4 inflowing 46:13 inflows 112:19 influence 57:16 inform 106:11 170:17 210:10 219:23 information 54:19 85:24 94:6 208:20 210:2,12,20 information's 96:21 information-sharing 208:7 211:2 informed 215:8 216:2 222:5 223:4 informing 150:10 informs 205:14 infrastructure 22:21 48:7 52:2,3 53:9 infused 189:10 inherent 25:1 60:24 inherently 134:21 inimical 126:22</p>	<p>initial 107:17 initially 34:20 206:9 injuncts 82:11 108:7 injunction 195:9 196:8 injury 215:10 innovations 213:7,9 216:25 innovators 66:4 input 74:18 inputs 74:13 98:3 210:8 inserted 188:21 insight 4:19 11:12 105:22 insights 105:18 212:25 insignificant 188:16 189:1 190:20 insisted 26:6 insofar 174:2 184:16 197:5 instability 19:22 39:25 installation 94:22 installations 104:2 installed 45:24 67:15 67:18 69:17 70:15 88:3 201:15 installing 57:13 instance 13:20 17:15 27:20 30:19 36:5 42:17 48:3 52:15 53:5 55:6 58:5,22 108:22 109:19 221:8 223:15 instances 221:16 instead 28:13 31:21 41:10 125:17 126:2 155:22 196:9 instruction 152:19 instructive 127:3 intact 56:19 intake 25:16 37:8,22 37:24 38:2,13 56:8 56:13 intakes 21:14,15,23 48:7 124:22 201:23 integral 198:6 integrate 64:1 88:25 106:22 integrated 3:10 2:15 5:2,7 62:21 63:1,14 70:7 71:3,9 85:15 89:25 96:23 integration 63:8 intended 4:8 5:12 171:22,23 202:2 211:1,4 intending 166:16 intense 191:1 intensity 54:12 intention 171:21 interactions 133:16 interconnected 69:21 69:25 70:12 interconnection 69:19 70:20 98:11 interconnections 70:24</p>	<p>interest 48:10 interested 15:13 20:22 20:25 24:2 113:13 133:6 220:25 222:21 interesting 12:23 13:6 18:18 23:7,16 25:20 32:10 45:16 71:2 92:8 109:23 165:15 203:13 interests 210:11 interest's 64:8 interference 183:5 184:7 186:18 187:3 188:9,14,19 195:10 195:11 209:3,8 intermittent 68:20 internally 5:3 international 134:20 135:16 142:7 143:8 144:18 146:21 147:4,5,6,8,14 150:19,23 160:14 160:19 167:3,16,24 168:18,24 169:2,4,5 184:17 194:7 215:13 222:6,7,11 222:15 223:4,9,13 interpret 136:5 160:13,18 194:1 218:20 interpretation 3:14 2:11,18 6:7 7:13,25 8:9 115:24 116:2 117:24 118:3,11 121:7,22 122:13 123:13,14 124:10 128:5,7 129:14 131:17 132:14 134:22 135:3,5,15 135:23 136:10,19 137:2,21,24 138:1,2 140:16,21 153:12 154:1,12,19 155:8 157:11 158:11,20 158:24 159:8,23 163:12 168:23 169:19 174:25 175:15 182:5 188:3 192:1 193:22,25 194:12,14,19 196:5 217:2 interpretations 128:13 135:18 157:23 interpretative 3:9 8:12 10:23 126:17 152:7 158:17 159:16,18,21 160:4 160:6,10 161:9 173:15,17 218:18 interpreted 194:9 218:4 interpreting 211:25 interruption 47:9,10 52:13,22 53:22,24 54:2 202:17 interruptions 94:3</p>	<p>99:7 inter-state 167:10 introduced 43:23 introduces 186:1 introducing 112:6 186:18 introduction 15:12 71:19 116:14 introductory 11:10 inundated 55:8 inundating 54:6 invalid 130:24 invariably 135:1 invert 27:9 investment 58:8 73:12 73:16 79:21 investments 79:20 investors 79:21 invite 11:7,16 invocation 214:17 216:23 invoked 215:25 invoking 214:11 involve 117:15 205:1 involved 37:10 66:12 72:20 92:12 104:1 105:23,23 106:21 107:9 112:7 113:12 involves 44:4 175:5 188:3,16 iPad-enabled 11:24 IRENA 92:1 Iron 215:20 irrespective 128:12 irrigated 18:20,23 205:11 irrigation 19:8 30:18 41:23 49:14,15 52:23 53:2,19 197:11 205:9 ISLAMIC 1:16 2:2 isolated 70:4,5 71:3 85:15 106:25 109:6 issuance 156:25 157:3 issue 8:7 15:18,20 21:10 29:16 32:8 35:18 52:21 68:24 91:3 113:6,17 122:1 122:16,23 129:10 131:4 132:13 133:2 133:4,9 135:17 145:5 150:6 152:18 153:20 158:10 160:8,17 165:13,19 168:16 171:16 172:9 175:1 191:4 191:12 216:4 222:9 issued 116:17 issues 3:14 2:16,18 3:4 3:19 4:6 5:13,16,24 6:4,17 7:10,24 8:1 8:12 17:25 45:6,7 50:11 115:24 116:2 117:18,18 118:3,5 118:10 119:1 121:6 122:2,12 124:3,11 127:11 131:7,15 133:10 135:24</p>	<p>136:1 137:6 141:21 144:6,13,14,24 156:23 164:15 171:10 173:1,12 176:13 179:1 181:19 182:8 200:23 211:8 213:23 222:14 223:12 item 30:2 items 76:15 98:19 iv 121:20 138:10 IV(12) 203:9 IV(2) 204:21 IX 1:1 2:21 119:13 120:9 127:9 140:14 140:20 142:5 143:1 146:6 173:5 180:23 211:9 I(10) 203:1 I(11) 204:9,15 205:4 I(15) 188:5 I(9) 205:7</p> <hr/> <p style="text-align: center;">J</p> <hr/> <p>J 2:14 Jagan 56:2 JAMAL 2:8 Jammu 70:10 190:20 190:23 January 130:13 Japan 26:19 43:10 Japanese 43:11 JEFFREY 1:11 jeopardy 145:22 Jersey-Maryland 78:4 Jhelum 190:22 202:9 206:12,17,21 219:21 job 86:20 join 8:8 joins 206:17 Judge 1:10 167:13 judgment 148:16,22 149:10 150:4 158:6 165:21 215:14 judgments 150:18 judicata 126:23 142:6 142:13 143:2,6,22 144:17,19,25 145:3 145:18,20 146:8,16 146:19 147:1,3,18 147:24 148:6,14,24 149:2,4,22 150:21 156:10 157:9,13,23 158:5,7,15 161:19 161:22 162:2,14,18 162:18 163:23 164:7,12,20 165:11 165:22 166:2,5 172:4,25 173:2 174:1 177:6 180:8 judicial 143:8 146:21 147:7 167:25 July 1:6 1:1 116:4 141:8 jump 149:25</p>	<p>jumping 94:21 jumping-off 4:9 June 96:21 191:7 jurisdiction 149:23 174:12 jurisdictions 43:19 166:24 jurisprudence 119:23 120:1,10 144:21 145:18 147:13 168:18,24 169:5 194:7 justice 147:7,14 Justice's 215:13 justify 125:19</p> <hr/> <p style="text-align: center;">K</p> <hr/> <p>Kali 36:23 37:6 Kantoush 43:10 Kashmir 41:11 56:2 70:11 190:20,23 Kathmandu 37:13 KC 2:9,11 keep 28:7,8,10 33:12 114:24 key 73:7 74:13 81:23 91:3 92:25 95:1,5 149:14,15 197:15 keys 98:8 KHAN 2:5 KHEP 6:12 123:2,9 125:13 136:16 152:2,21 153:7 154:5 155:6 161:25 178:10 214:22 KHEP/RHEP 117:17 kill 41:20 kilometre 59:3 kilometres 18:20 22:10 27:2,12 37:13 39:5 53:15 kilowatt 22:20 75:19 81:15 92:22,24 93:2 kilowatts 81:17 kind 13:6 111:18 165:19 220:12,18 kinetic 80:18 KING 2:20 Kingdom 2:7,8,9 kink 37:24 Kishenganga's 155:25 Kishenganga/Neelum 161:24 162:12 knew 56:23 know 3:24 4:21 8:25 15:17 18:17 24:15 48:10 49:13 50:12 54:1,20 58:15 67:23 92:3 103:1 105:15 134:17 135:21 169:25 201:21 206:1 209:16 216:13 220:6 221:24 knowledge 203:21 known 21:1 174:20 Kotri 19:2 Kulekhani 15:22</p>
--	---	--	---	--	--

<p style="text-align: center;">L</p> <p>L 2:13 la 174:7 Lafitte 124:2 135:13 Lafitte's 6:1 175:22 laid 6:6 lake 54:25 190:22 lakes 55:7 land 14:11 16:6,7 25:12 205:10 landscape 16:4,5 landscapes 16:17 landslide 21:20 54:25 55:7 landslides 14:24 15:21 16:3 61:22 language 9:8 143:17 167:9 187:16 188:13,21 196:25 197:18 212:19 Lanka 20:24 laptop 11:24 large 12:24 15:24 19:9 27:17,24 28:21 30:4 31:22 32:1 38:25 41:1 46:19 52:15,16 52:16 54:21 55:25 57:14,18 69:8,14 70:17,18 82:2,4 94:20 96:23 98:3 99:7 104:1 222:12 largely 67:4 68:2 70:6 97:7 161:23 201:10 larger 26:16 39:16 46:1 57:25 76:23 98:12 largest 39:3 69:5,13 89:23 97:16 large-scale 215:22 last 1:9 7:21 54:8 57:11 67:8 103:21 111:11 133:22 141:8,23 204:16 220:25 late 65:2 later 77:13 96:5 136:3 137:23 139:9 143:5 143:12 150:16 171:14,25 179:19 179:21 181:3 203:22 219:23 latest 116:5 136:12 latitude 114:19 latter 94:2 95:25 121:23 126:24 LAURA 2:12 law 45:9 126:13 134:20 135:16 136:4 142:7 143:6,7 144:6,6,14,18 146:20 147:5,7,15 160:14,19 166:24 167:3,16,22,24 168:19 169:2,2,4,7 221:6,14 222:6,8,11 222:15 223:4,9,9,13 lawn 2:2 lawsuits 45:10</p>	<p>lawyer 23:17 135:2,2 lay 48:3 121:6 layer 1:18 2:7 3:9 layout 74:2 201:15 lays 48:4 LCOE 94:5 leading 7:1 leads 72:17 199:12 learn 51:5 learned 13:10 learnt 13:12 least 1:22 20:7 32:8 73:9 100:12 134:18 135:2 154:25 157:12 170:22 176:14 210:1 leave 103:1 led 69:4 139:22 left 32:12 67:22 68:5 68:10 86:2,8 left-hand 43:5 56:7 79:2 94:16 187:17 190:11 legal 2:5,20,20 2:16 5:16 47:21 119:12 120:25 121:3 122:20 123:4 125:2 125:16 126:23 127:13 131:10,16 132:19 134:1,12 145:16 149:12 150:23 157:12 177:19 182:6,13 213:1 legality 151:18 153:10 154:10 legally 125:24 length 170:20 208:17 lengthy 135:14 less 1:22 21:17 22:19 30:6 31:13 57:25 59:19 61:21 77:1 84:5 88:3 132:1 146:24 150:24 203:21 lessons 13:12 let 1:16 8:23 9:3,11,17 15:2 17:18 22:2 25:7 31:4 53:10 62:7 105:8 169:25 183:4 184:4,6,14,19 185:8,11,15,18,22 187:25 192:2 193:13 211:17 220:24 221:9 letter 7:2 43:22 130:21 131:13 186:12 187:2 letters 130:12 let's 30:9 34:8 36:1,22 39:18 44:25 49:2 50:6 80:2 115:6 179:19 let-flow 161:1 195:8 195:15 204:14 level 3:5 17:19 28:8,9 28:10,10,13 29:4,5 29:6,13,14,18 33:11</p>	<p>33:13 36:2,2,3,7,9 36:12,19 37:23 38:16 39:9,10,20 40:11 74:1 75:20 81:24 82:3,17 85:20 91:2,3 99:8 108:14 109:3,10 129:3 152:11,11,23 198:23 199:5,12,13 199:18 levelised 92:9 levels 29:3 32:21 84:17 154:21 lex 168:21 Liberia 106:21 licence 205:4 life 111:13 163:24 lifecycle 92:12 lifetime 65:7 lifted 20:21 light 68:9 84:9,12 114:25 160:13,19 167:1 202:21 like 2:5 4:5 8:6 11:1 13:20,21 15:15 19:18 20:4,9 22:15 22:23 25:3 32:6 38:15 44:2 45:23 46:5,6,12 48:8,11 49:21,21 51:11,16 52:19 53:24 57:3 58:20 59:3 60:7 65:4 71:19 77:10 84:23 94:24 101:1 102:25 107:18 108:9 110:22 112:1 113:4 116:12 122:19 141:7,20 143:20 164:11 168:19 170:14 219:25 222:3 liked 15:12 likely 54:11 94:13 210:11 limit 164:5 169:7 190:3,21 200:16 217:24 218:1 limitation 61:9,20 95:2 154:6,8 156:14 158:13,25 159:11 162:13,15,19,20,22 181:1 206:20 limitations 57:6 61:11 62:2 63:23 95:6 107:5 156:16 157:8 157:21 191:16 202:6,12 206:23 213:17 limited 14:3,3,24 41:16 43:5,14,15 88:16 91:21 99:14 100:17 102:18 103:11,13 145:13 154:4 159:1 160:5 165:5,25 168:14 172:13 173:6 176:14 177:6 185:18 190:15</p>	<p>198:1 203:8,18 204:20 205:21 limits 60:24 127:12 131:3 166:22 203:9 205:8 line 19:17 32:14 33:10 39:21 66:16 67:11 97:3 204:19 215:1 lines 167:8 link 212:25 linked 194:17 208:19 liquid 91:10 Lisa 1:23 list 124:11 173:6,8 listed 78:2 204:11 lists 69:10 literally 175:23 litigant 149:10 litre 41:8,12,20 little 2:9 11:12 19:10 20:12 21:20 26:11 31:10 35:10 37:7 53:11 57:5 83:24 91:19 113:24 114:4 114:18 132:1,11 169:15 170:10,12 171:20 213:15 221:5 live 122:16 196:22 198:2,5 199:3,8 lives 65:18 LLOFs 54:10,14 56:23 LLP 2:11,12,12,13 load 14:15 19:9 26:18 26:18 27:8,8,9,22 35:17 37:2,5,7 38:2 38:13,23,24,25 39:4 43:17 46:10,13,14 46:15 47:17 48:18 48:18,20,21,22 59:23 60:1 77:20,22 78:15,17,19 83:2,13 83:24 84:1,4,19 85:22 86:15 87:3,19 87:24 88:6,23 95:10 99:4,10 104:14,20 108:18,19,22 109:8 109:9,13,16,17,22 110:11,17 111:10 111:14,25 115:22 213:6 loading 104:16 loads 14:20 29:24 48:19 85:11,11,12 85:12 88:11 199:11 213:4 load-stacking 109:2 local 44:9 98:10 locally 71:7 92:16 locate 35:1 located 37:12 90:19 196:8 location 34:22 201:14 locations 50:22 155:22 202:9 locked 51:17 logical 24:10</p>	<p>London 2:9,10,10,11 2:11,12,12,13 long 19:25 20:1,4 39:5 88:10 107:15 144:2 185:13 longer 26:16 58:23 65:9 85:14 162:11 163:6,7 164:20,24 longest 45:13 long-term 17:5 look 9:8 15:5 23:7 32:21 37:1,3 39:18 44:13 46:9 48:17 49:3 65:7 66:14 80:2 86:22 90:2 92:8 93:16 101:24 113:5 133:5 169:12 169:25 179:10 182:1 183:16 221:4 looked 24:10 42:11 52:11,18 112:16 125:9 132:13 148:2 148:25 158:23 looking 4:13 22:13 37:19 43:10 56:6 57:13 58:2,4 63:14 64:21 67:23 86:20 183:13 184:16 188:3 194:20 202:20 looks 52:19 107:17 lose 18:8 loss 15:25 losses 90:20 lost 12:6 17:16 20:10 20:12 155:3 lot 13:3 16:20 20:9 23:13,25 25:5 27:25 30:25 40:21 41:25 42:6 43:18 44:10 45:6,8 46:22 49:22 50:10,24,25 51:12 51:16 55:11 58:7 89:13 98:17 102:23 104:22 105:16 106:17 199:6 200:1 lots 25:4 138:19 low 31:10 35:17 39:10 39:25 48:18 56:5 58:22 lower 26:21 94:13,13 103:12 112:19 186:17 lowered 41:12 lower-right 68:9 low-flow 76:3,4 lunch 113:22 114:5,10 115:20 170:11</p>	<p>174:17 181:4 187:9 190:21 191:5 200:9 212:24 magnitude 199:8 main 61:17,18 63:12 64:23 89:20 146:7 148:22 161:2 202:8 mainly 92:9 103:2 maintain 29:5 31:17 32:24 81:22 82:20 108:2 202:2 209:20 maintained 123:7 124:1 maintaining 202:7 216:7 maintains 28:23 maintenance 177:12 214:21 major 16:20 35:18 37:16 majority 16:16 67:2 make 3:20 7:18 8:20 8:23 12:4 13:10 15:2 22:2 23:5 31:18 34:8,25 49:1 50:3 61:25 68:8 73:5 79:19 84:14 109:14 110:3 116:13 121:17 133:24 139:16,24 151:25 163:7 167:7 170:21 171:1 173:17 189:9,19 makes 43:24 68:13 85:23 134:14 140:10 141:11 158:25 168:20 172:16 187:24 188:13 making 48:9 71:2 88:9 99:4 107:17 134:7 189:14 manage 12:18,21 15:18 20:14 49:8 52:20 57:20 managed 1:9 20:3 52:8 71:14 management 12:15,18 13:8,11 14:2,4,12 23:18 24:8 35:7 42:23 47:16 51:14 52:3 57:23 59:11,13 60:2,21 109:25 110:1,9,19,19,20,23 213:8 Manager 2:21 managing 37:7 54:15 mandatory 196:25 199:24 Mangla 14:19 mangle 9:19 manifest 122:23 manifestly 120:9 manipulate 218:5 manner 32:11 70:1 137:13 219:1 many 12:25 19:19 43:19 50:13,14</p>
---	---	--	--	--	--

<p>57:15 58:19,20 62:5 70:3 73:14 74:7 93:22 104:2,6 110:20 112:2 114:12 119:25 146:25 147:12 172:7 178:19 man-made 188:10 mapping 55:13 March 127:20 Marine 44:7 market 73:16 marketing 91:23 markets 73:14,20 marks 216:16 massage 223:18 massive 21:22 match 82:13 85:3 89:11 101:13 107:4 107:12 matched 107:13 matching 184:3 material 26:25 27:5,6 31:3 35:16,19 46:2 59:24 204:24 209:13 materially 56:18 209:5,9 materials 212:7 222:1 matrices 138:24 139:6 139:15,24 178:13 matrix 138:23 139:20 139:21 178:16,23 179:10,25 matter 1:1 88:9 126:13 129:2,12 134:4 142:7,15 143:4 169:19,21,24 172:19 174:17 179:13,21 matters 117:4,14 121:21 137:2,4 139:11 140:25 158:7,8 172:13,17 173:16 178:25 182:18 mature 93:6 maximise 91:22 218:5 maximises 31:7 maximum 29:13 32:2 41:13 112:13 129:14,20 199:14 may 3:11 8:5 11:21 23:17 29:12 40:25 41:1,2 47:3 55:13 60:1,5 68:23 85:4 100:19 102:11 103:15 115:2,4,8 119:23 131:23 132:19 135:4 141:5 142:19 146:10,14 148:14 150:1 154:13 155:21 158:4 162:5 164:3,4 165:7,19 167:13 170:18 173:12 181:15 191:11 192:16 193:25</p>	<p>206:25 208:22 215:10,17 221:11 222:20,20 maybe 23:10 29:11,11 29:11 33:16 35:10 51:19 55:18,19,20 55:21 58:1,2,21 59:2 100:23 169:11 170:25 213:11 221:12 McGowan 1:23 mean 13:1 22:11 37:23 50:12 61:1 98:24 103:13 108:4 112:18,19 132:5,6 143:19 165:15 188:22 meaning 7:14 75:11 142:15 147:17 148:6,15 154:1 194:16 198:13,14 198:25 199:7 218:20 means 15:1 32:7,8 33:25 35:4 53:24 79:6 82:25 99:20 116:24 147:20 185:15 197:23 207:23 meant 126:7 169:16 186:4 208:19 219:9 measurable 60:5 188:25 measure 59:25 60:13 211:13 measurements 60:6 mechanical 80:5 mechanism 162:8 mechanisms 142:19 media 54:20 meet 71:15 72:12 73:10,12,19 74:17 199:9 meeting 71:1 127:20 128:19,20 129:18 129:18 130:8 meetings 127:5,6,17 133:20 MEGAN 2:13 megawatt 58:3 86:5 megawatts 77:15 81:17 86:4 90:9 MEHAR 2:4 members 1:14 3:6 5:4 7:16 10:20 62:22 115:19,25 141:14 146:23 171:8 182:23 224:8 Memoire 186:25 memorial 112:17 113:3 122:24 140:4 143:3 169:14 171:15,19 213:21 221:10 222:19 mention 12:2 35:13 50:19 mentioned 22:23</p>	<p>29:23 40:19 42:11 43:3 53:3 54:9,9 58:6 60:20 108:19 165:2 180:10 191:12 198:13 206:25 220:10 mere 216:22 merely 76:10 merit 119:18 149:24 merits 1:7 6:25 7:23 message 43:13 met 163:10 197:20 method 77:19 112:12 112:15 methodology 6:2 106:12,18 129:19 methods 50:15,20 51:10 76:18 metre 16:6 32:19 metres 18:5,6 25:23 25:24 31:1 32:18,18 32:18 34:8 46:4,6,9 201:9 middle 64:16 79:13 92:18 midst 3:17 mid-1940s 66:18 might 5:7 7:16 11:20 23:24 52:9 62:10 71:6 74:7 93:14 114:3,18 133:7 140:18 143:19 145:14 146:16 163:10,11 168:1 170:12 191:13 219:12 221:7 222:23 miles 2:10 75:11 102:15 111:12 112:24 113:11 148:4 Miles's 113:6,10 milligrams 41:8,11,20 millimetres 18:22 million 18:2,6,19 23:12,13 37:4,6,6 39:4 46:8 201:9 milliseconds 107:7 mills 64:12 215:14 mimic 44:16,22 mind 10:25 15:10 51:8 57:7 112:22 167:14 mindful 157:23 minds 165:1 190:8 213:18 Minear 1:11 59:8,9 60:19 107:22,23 108:17 109:12 111:11 112:5 166:24 167:9,17 184:14 192:24 206:6,7,8,12,14,16 206:18 207:3,7 217:23 219:13,16 219:25 minimis 204:13 minimise 33:1 111:1 minimises 47:10</p>	<p>minimum 23:10 28:8 29:5 39:20 40:20 112:18 161:23 162:9 165:2,5,13 166:10 212:11 214:22,24 215:2 mining 203:7 Minister 186:13 Ministry 2:4,5 minor 78:10 85:5 94:18 101:11 minute 22:3 85:24,25 111:20 minutes 25:3 78:20 95:12 114:19 115:14 122:19 170:22,25 misnomer 33:7 misplaced 136:4 mistaken 219:22 mitigate 110:6 215:21 mitigation 40:24 mix 71:25 106:23,23 134:20 Mm 16:11 model 36:6,6,7 modelling 107:19 moderate 58:12 96:11 97:6 moderating 108:4 modes 81:25 modifications 19:6 modify 38:10 49:7 moment 1:24 69:7 77:23 84:22 158:21 moments 70:24 Monday 112:12 208:5 money 23:1 55:20 111:5 monitor 82:19 monitored 53:14 monitoring 40:24 189:19 210:6 monitors 82:9 monsoon 15:24 18:8 38:25 month 23:13 87:6 106:19,19 monthly 72:19 75:18 210:9 months 38:25 210:1 more 2:9 4:21 9:6 11:12 15:2,15 16:6 20:12 22:2 25:12 27:23 30:6 31:13 34:4 35:10 43:11 49:1,14,15,15 51:19 54:5,18 55:21 56:22 57:11,14,18 58:24 59:19 61:22 63:10 67:8 70:7 79:18 84:5 89:13 90:3 93:4 100:18,21 101:7 102:2 103:2 103:12 104:22 105:1 106:9 107:19 109:20 110:17,19 111:4,8 113:5 114:4</p>	<p>127:4 128:9,24 132:11 133:15 134:6 135:25 141:14 142:1 144:25 151:13 159:3 160:5 162:21 165:10,14 166:5,16 171:20 172:13 176:14,25 178:22 184:6 192:13 203:5 203:20 208:10 221:5 Moreover 159:18 morning 1:3 3:15 12:14,15 111:5,6 193:20 194:12 212:25 224:4 morphology 16:22 19:23 Morris 2:13 3:5 1:15 2:4,12,13 3:23 4:17 11:8,16,19,23 12:10 12:14 15:10,20 16:11,14 17:2 20:6 20:21 21:7 23:15 24:5 32:4,10 34:2 35:13 51:24 52:10 54:19 56:25 57:22 59:9,15 60:20 61:7 212:24 213:2 218:15 219:2 Morris's 3:16 4:7 mosque 56:16 most 16:1 17:10 19:3 27:17,17 41:20 64:17 79:16 92:5 93:19 97:11 103:18 110:13 159:15 209:16 214:8 216:7 mostly 52:5 motivated 154:14 217:8,13 mountainous 25:18 54:10 mountains 49:18 61:24 move 9:19 15:14 21:20 30:8 31:3 32:19 34:24 35:19 39:1 47:7 59:2 115:7 143:10 163:17 167:19 moved 13:9 moves 30:22 108:9 moving 7:4 35:20 161:16 201:19,24 much 1:8 8:3 11:1,7 12:9 31:18 51:24 54:7 59:5 60:16 62:4,5,6,8,14 74:14 76:15 91:15 93:11 96:9 102:2 105:7,13 112:4 113:18,20 115:9 133:16 134:6 135:25 137:9 150:14 171:2 172:7 178:22 182:15 189:17 190:8</p>	<p>201:13 216:24 MUHAMMAD 2:4 multidisciplinary 134:18 multipurpose 39:7 municipal 203:4 Murphy 1:10 10:17 must 3:3 10:3 73:20 74:17 76:6,8 78:1 79:18 80:20 84:11 85:25 86:15 91:5 98:4,5 126:19 134:25 136:11 141:12,13 142:18 147:9 149:11 163:7 173:10 183:4 190:18 210:10,15 212:8 221:16 MUSTANSAR 2:6 mutual 137:8,17 208:25 mutually 118:20,23 MW 22:7,10,11 36:24 39:3 45:4 46:5,6,7 54:25 56:3 58:2,2,3 58:7,13,14 69:17 70:16 86:21 90:17 97:21 myself 105:22 219:20</p> <hr/> <p style="text-align: center;">N</p> <hr/> <p>name 32:16 namely 117:16 118:16 128:10 151:18 152:20 156:23 narrative 150:13 narrow 34:11 187:10 194:14 217:4 narrower 1:19 2:8 narrowing 203:11 narrowly 194:3 NASIR 2:8 nation 66:22 108:21 National 44:7 natural 30:6 44:16,18 44:22 79:14 91:11 97:17 103:24 nature 105:7 nature 20:2 31:10 57:11 68:20 120:11 121:15 127:23 133:15 137:5 141:24 142:21 144:23 147:1 153:1 153:9 154:9 155:11 156:4 157:9 163:3 168:8,13,15,20 173:7 184:21 210:23 near 97:4 necessarily 6:23 101:12,23 necessary 7:13 32:6 85:1 119:23 137:8 145:1 148:8,14 167:23 212:14 223:10 necessitate 166:11</p>
--	---	---	--	---	---

<p>necessity 223:6 need 1:21 7:7 8:8 15:6 30:7 32:10 42:5,8 50:6 55:12 68:20 85:7 89:14 91:4 95:4,12 101:9,10 102:21 110:6 115:3 116:7 119:20 122:6 135:1 138:22 164:4 165:7 168:17 180:19,22 181:15 182:12 194:11 needed 83:3,25 85:2 95:18 100:15 134:8 167:7 needs 112:9 194:3 Neelum 206:15,16,18 206:25 219:21 Neelum-Jhelum 3:20 4:6 5:5 27:11 59:12 59:14,23,24 82:4,22 105:16 negate 221:19 223:7 negated 222:5 223:5 negotiation 191:1 219:5 negotiations 176:20 186:11,14 Nepal 15:23 36:25 55:5,8 net 178:15 Netherlands 1:5 2:7,8 2:9 neutral 2:21 5:21 6:13 6:21 7:5 112:25 116:21,23 117:10 117:14 118:1,6,12 118:19 119:6,8,10 120:19 121:11,14 124:8,15,16 125:3 125:16,18 128:6 129:7,11,13,22 130:3,22,25 134:13 134:24 135:4,12 136:22,25 137:7,20 138:2,10,15 139:4 139:12,21 142:3 151:8 156:7 157:25 159:20,24 160:6,16 160:24 161:12 163:17,19 167:19 168:9,15 169:19,21 172:6,10,12,17,23 173:5,10,14,17,22 173:25 174:6,10,15 174:19,24 176:1,15 177:7,11,25 178:7 178:21,21,24 179:2 179:13,17,20 180:1 180:15,22 181:5,10 181:22 never 9:20 38:4 58:18 125:23 126:12 133:12,21 134:1 175:18 nevertheless 59:7 new 71:25 73:3 90:12 94:14 148:24 149:1</p>	<p>163:7 171:24 186:19 190:21 196:24 197:15,21 197:23 199:20 203:21 216:9 next 1:18 2:7 16:7 17:3 37:3 42:8 60:17 61:8 66:24 72:14 111:6 115:16 115:21 122:4 128:19,19,20 129:17 130:8,10 133:22 134:8 140:8 143:7 151:22 152:9 153:24 154:11 159:4 165:17 191:22 198:10 200:1 Nicaragua 145:4 148:18 night 1:9 109:8,21 219:12 nighttime 87:23 95:3 95:18,20 96:1 Nil 206:21 Nile 19:19 noise 1:22 nonsensical 126:19 non-appropriation 185:12 non-binding 139:13 non-consumptive 190:14 204:8,17 non-interference 9:3 9:12 184:20 186:2 188:6 192:2 193:14 195:16 209:12 211:18 non-invasive 203:3 non-operational 198:18 non-Treaty-based 3:2 211:23 212:2,17 normal 75:2 115:1 199:13 normally 33:21 North 103:19 110:14 northeastern 69:22 northern 69:22 70:9 70:15 notable 156:3 159:15 notably 6:7 127:13 149:20 153:13 176:16 note 4:7 65:19 66:9 75:1 86:7 93:2 94:6 97:22 113:24 125:21 204:15 211:10 216:15 noted 112:7,12 117:5 119:24 123:16 130:1 162:2 187:2 201:11 nothing 124:22 147:20 notice 97:3 170:4 208:16 notify 209:5,14 noting 185:6 216:14</p>	<p>notwithstanding 120:4,5 136:16 no-storage 190:6 211:18 nuanced 134:6 177:1 nuclear 5:8 79:14 91:10 number 3:3,20 5:4 14:16 20:1 37:3 38:10 46:6 53:21,21 53:22,23 54:2,3 59:21 61:5,16 77:18 101:19 105:20 116:13 122:14 125:8 145:24 163:18 182:11 217:25 numbered 121:20 138:9 numbers 18:18 23:2 93:16 201:13 nut 58:4 nutshell 49:20</p> <hr/> <p style="text-align: center;">O</p> <hr/> <p>object 108:2 135:19 136:7 142:15 182:5 189:25 194:15,18 200:4,5,18 212:5 217:14 218:21 219:1,3 objected 157:7 objection 123:19 objections 201:6 objective 18:11 26:11 28:1 32:24 38:9 63:2 objectives 190:2 obligation 9:11 50:6 161:1 184:3,5,6,20 185:9,11,15 188:6 194:16 195:8,15,16 204:14 209:12,14 210:13,24 211:18 obligations 9:3,25 47:2 208:12,14,15 217:20 222:5 223:4 obligatory 147:22 150:20 obliged 204:4 209:5 observation 7:18 8:20 8:23 189:18 observations 102:25 103:2 observe 71:2 200:2 observed 117:21 175:2 193:21 213:14 221:16 observes 120:20 observing 148:11 obstruction 188:10,15 obtained 90:8 149:11 obvious 49:6 obviously 57:15 113:13 160:21 occupying 34:20 199:17 occur 54:10</p>	<p>occurred 55:11 occurring 108:14 occurs 98:2 ocean 19:1 89:22 off 16:12,15,21 22:11 23:9,11 24:18,19 30:1 40:16 44:14 52:6 65:23 71:17 95:16 96:19 98:1 110:25 170:15 offer 91:15 offered 216:11 office 2:6 59:16 offshore 92:6 offtake 203:7,8 Off-channel 25:15 off-stream 25:8,16 26:1,5 often 78:11 89:17 111:14 221:25 Oh 206:16 oil 68:3 79:14 82:5,11 108:7 oil-fired 93:23 okay 1:25 24:5 30:13 62:18 106:5 115:14 167:20 171:6 182:15 omnes 129:9 once 24:23 94:8 114:14 121:10 200:18 202:16,19 one 3:14 4:2 5:24 7:18 8:4 9:8 15:2,22 17:6 17:12,25 18:8 22:2 23:13,21 24:22 27:22 28:25 29:11 29:17,18 34:22 35:25 37:10,25 42:7 42:8 43:18 52:1 53:21,22 55:7 56:1 58:5,8 61:8,16 68:19 79:4,16 82:2 85:13 88:24 89:5 90:17 92:23 93:14 95:6,25 98:8 106:3 106:17 107:24 108:25 109:5 110:2 111:11 125:21 128:20 130:13 132:18 133:22 134:9 137:21 139:16 146:25 150:1 155:19 163:10 165:16 167:21 168:1,5 169:10 179:9,19 181:14 183:1,6 184:24 187:16 190:2 193:10 196:21 198:4 200:10 204:17 216:6 220:23 221:2 221:4,6 222:18 ones 79:8,13 one-and-a-half-hour 115:5 ongoing 45:11 63:25</p>	<p>101:25 119:7 122:20,22 123:3 127:9 131:9 209:22 210:23 only 1:9 11:23,25 17:20 19:14,14,17 26:18,22 34:16,17 41:17 55:3 60:1 69:17 76:11 83:6 85:19 86:7,10 88:1 88:14 94:14 95:24 99:10 104:19 118:4 120:25 123:15 124:10,12,17 126:2 126:8 129:4 130:15 135:10 155:3 158:16 161:10 172:12 173:12 174:18 178:24,25 182:3 185:21 188:16 190:20 191:8 195:7 199:8 203:23 204:9 212:3 214:12 217:16 onshore 92:6,23 on-purpose 52:3 on-stream 25:9 open 27:16 28:2,8 30:13 42:1 52:16 73:14 82:12 166:4 179:21 216:24 opens 166:1 open-cycle 93:23 open-ended 4:3 operable 41:23 operate 15:7 22:13 29:6,9,12,13 38:11 39:15 66:5 77:11,19 83:18,19,22,23 84:14 87:15 110:22 208:7,8 215:6 operated 83:12 197:16 operates 81:13,19 108:6 operating 20:8 22:21 28:9 29:5 38:15,18 39:6,20 40:19 68:18 80:3 81:25 82:24 83:1 84:19,20 198:23 199:16 operation 3:3 3:19,22 4:23 12:12 29:22,22 37:21 39:15 42:9,14 59:14 62:25 63:7,10 77:5,10 89:15 100:19 102:20 105:17 117:17 120:21 123:18,20 131:1 136:13 156:25 157:3,18 158:3 159:10 161:25 166:19 175:12 176:2 200:9 201:18 202:2 208:21 210:6 211:3 211:8 216:18 218:6 222:16 223:12 operational 22:22</p>	<p>201:25 211:24 212:3,17 218:13 operationally 199:5 operative 147:25 148:1,15,19 156:8 operator 37:18 71:14 82:23 86:12,13,15 86:23 97:1 operators 19:2 26:6 opinion 101:25 opportunity 3:18 5:13 121:5 170:5 214:15 opposed 103:2 158:5 165:21 192:8 opposite 111:19 optimal 71:25 105:2 175:12 200:9 optimally 89:11 optimisation 107:14 optimising 39:14 optimum 73:5 option 18:1,25 46:19 57:14 options 12:15 24:7 50:25 51:17 73:2 orange 1:10 66:1,16 order 8:8 37:6 46:8 77:7 84:11 88:11 90:9 106:24 115:17 116:3,16 118:7,8 119:17 135:5 137:10 148:5,13,23 183:21 211:13,22 218:12 ordinance 3:25 170:19 224:8 ordinary 194:16 198:14 199:1 218:20 organisation 92:1 organise 118:9 orientate 122:8 orientation 118:13 orifice 33:21 36:11,13 178:2 original 39:11 201:1 originated 13:5 origins 116:15 others 11:14 19:20 155:23 158:8 182:11 otherwise 5:19,20 131:12 134:19 136:23 140:1 141:5 142:21 145:20 147:14 156:8 158:18 162:14 163:3 174:11 175:18 176:12 179:3 193:3 224:10 out 21:13 22:8 23:2 24:1,11 26:16 27:23 30:13 31:4 38:1,18 40:5,16 41:10,10 42:7,10,14 43:7 45:25 48:11 54:20 55:18 56:12,15 60:10 67:1 70:14</p>
--	---	---	---	---	--

<p>107:10 134:7 139:5 140:15 148:16 154:15 180:16 183:25 184:14 185:24 192:24 193:15 194:4 195:22 196:9,16 197:6,7 202:1,4,4 204:25 206:3 210:20 211:25 217:7 221:9 outage 78:25 outcome 75:20 146:15 outcomes 107:13 outlet 20:18,18 21:4 36:20 outlets 201:23 212:12 outlines 12:17 outpace 90:13 output 81:3,8 82:18 94:20 outset 211:2 outside 1:23 2:2 166:10 169:22 172:1 174:3 180:12 181:5,11,23 191:11 214:2 222:12 over 1:6 7:20 17:16,23 18:3 21:4 27:23 30:3 46:15 50:13 56:4,11 67:9 75:17 78:19 81:14 92:17 92:21,23 93:1 97:11 97:21 109:18 111:13 112:20 164:9 198:10 200:1 202:23 204:16 224:7 overall 32:24 46:10 58:24 68:18 69:13 70:1 76:1 77:22 104:18 221:6 overflow 31:14 overlap 117:15 118:21 138:20 overlooks 217:17 overly 145:11 overnight 221:11 overriding 163:1 174:12 overruling 161:16 overtopped 55:17 overview 3:1 1:13 63:13 71:18 208:11 own 26:13 54:6 57:4 65:5 72:5 101:25 103:1 122:17 127:12 137:9 154:18 196:10 201:9 213:14 219:20 owner 15:2 owners 15:4 oxygen 48:5 oxygenated 48:2 o'clock 115:1</p> <hr/> <p style="text-align: center;">P</p>	<p>P 1:11 193:1 Pacific 45:4 pack 116:5 page 169:15 paid 22:20 55:12 paid-for 22:20 Pakal 42:18 Pakistan 1:16 2:2,6,8 2:8 7:3 9:25 14:19 17:7,9,9 19:19 23:24 27:10 30:24 49:5 50:5,7 52:6,12 52:19 53:20 56:3 90:3 105:25 112:21 116:22 119:2 121:5 123:3,6,19,22,25 124:24 127:22 128:5,12,21 131:16 141:25 143:3 150:10 151:25 157:7 161:5 166:6 174:20,23 175:17 181:10,15 182:10 183:2 184:3,16 186:6,17,24 187:4,8 189:7,12 190:16,24 191:5 201:17 202:15 203:14 204:1 208:13 210:9 210:10,13 216:10 219:3 221:12 222:21 Pakistani 122:25 128:3 131:12 Pakistan's 5:22 9:1,10 9:20,22 10:6,10 11:13 23:18 112:12 112:16 116:11,19 122:24 123:24 125:5,9 127:11 133:18 134:10,14 138:4,24 151:11 174:13 181:25 183:23 185:9 186:12,15 190:17 194:4 195:9 201:6 207:5 208:8,13 209:24 210:11,15 211:5 212:2 214:7 216:13 Palace 1:4 pale 97:4,19 pan 26:15 panel 106:22 paragraphs 122:12 124:19 125:7 135:17 139:8 140:5 140:7,9 141:16,22 145:14 148:5 162:1 163:14 165:17 172:8,15 173:13 182:13 193:15 202:5 205:8 210:20 211:11 212:20 parallel 65:10 116:23 119:8 120:19 142:20 parameters 107:2</p>	<p>parentheses 36:24 park 90:15,17 parlance 198:15 part 3:25 9:11 16:8,9 28:2 46:13,15,21 49:16,16 55:23 59:17 60:6 70:2 80:24 82:6 83:8 86:7 87:20,22,23 88:2 89:19 94:15 95:25,25 96:3 97:16 101:17 110:8,9,25 118:12 144:1 145:19 153:21 155:14 156:14 158:14 161:18 162:18 165:4,6 167:15 169:2 173:8 173:24 176:24 179:15 187:22 191:25 195:23 197:15,15 198:6 205:13 210:3 214:9 217:16,17 220:25 224:8 partial 32:8 83:13 123:7,22 125:14 132:15 141:20 151:1,22 152:25 154:13,15 155:11 156:12,17 157:1,4 159:7 174:22 175:16 200:8 201:11 partially 185:21 particular 3:10 4:24 5:10 7:19 9:13,16 32:5 33:20,24 54:5 97:12 98:20 103:25 105:19 106:11 111:23 113:6,17 114:2 121:23 122:11,15 129:12 135:10 137:6 150:8 154:2 164:2 165:20 165:25 172:19 173:23 175:1 215:18 217:3 221:3 particularly 17:9 28:21 54:4 79:9 123:1 131:5 220:25 parties 49:9 50:1 116:25 118:24 119:14 121:13 122:20,22 124:18 126:1 127:7 131:3 131:25 133:17 135:9 137:9,14 138:14 140:6,13 141:1,5,9,17,25 142:16,24 143:5 144:10,14 145:16 153:18,22 156:6 167:1 171:25 172:11 178:20,20 179:1 186:3 190:12 191:1 207:15 208:4 208:19 211:1 216:2</p>	<p>222:10,15 partly 167:7 parts 104:13 118:20 118:21 141:17 145:2 183:12 197:13 party 116:5 127:16 141:15 146:5,6 151:4 162:7 164:25 165:19 166:11,14 179:19 204:23,24 208:22 209:2,4,5,6 209:9,12 222:11 party's 208:12 part-load 83:1 84:7 pass 22:14 25:13 26:12,18,18 28:4,22 32:1 42:20 52:16 98:1 186:6 passage 158:21 164:14 164:18 175:7 176:24 passages 125:14 136:9 156:3 passes 22:9 passing 13:23 20:2 pass-through 33:6 past 2:20 119:12 Patrind 27:10 pattern 44:18,22 64:22 86:13 104:16 patterns 49:17 paucity 49:19 pause 1:24 7:17 12:14 12:16 63:11 67:24 127:3 149:24 158:21 182:18 paused 149:25 pay 23:3 47:4 72:19 PCA 1:3 PCIJ 150:20 PCIW 122:25 130:8 PCIW's 130:12 peace 1:4 219:4 peak 53:25 73:21 83:20,22 96:10 97:6 97:11 110:16 peaking 77:5,9 83:7 85:18 88:1 96:1,11 99:13 100:11,17,21 102:8,18 peaks 77:5 87:21 111:1 peak-period 88:14 peeling 8:13 Pennsylvania-New 78:4 people 15:4 41:1 51:3 55:2,12 76:13 84:12 106:19 107:17 110:3,20 people's 111:8 per 16:6 22:19 29:12 41:8,11,20 45:17 46:6 58:3 66:20 67:12 92:22,24 93:1 percentage 88:24 perform 37:21</p>	<p>performed 73:24 74:5 perhaps 1:5 3:25 4:1 7:16 8:9 10:6,17 11:19 33:21 101:7 154:24 159:15 162:13 168:9 169:25 171:19 208:7 221:19 223:17 period 7:1 19:21,22 20:20 30:4 40:10,22 41:15 65:13 67:1,9 74:7 75:17 76:3,6 77:4,6,10,11 78:19 81:13 83:5 92:21 96:1,1,10 99:12 181:1 219:6 periods 17:5 88:10 92:17 95:15,18 Permanent 1:4 2:18 147:13 209:17 permanently 45:24 permissibility 151:20 153:19 159:14 permissible 185:20 permit 44:2,3,19,20 152:10 164:19 183:4 184:7 195:10 211:6 permits 202:25 204:7 permitted 177:13 189:2 198:1 203:16 220:19 perspective 3:4 4:11 12:13 15:19 16:18 52:7 57:17,21 88:19 114:8 134:16 157:12,15 202:19 203:13 perspectives 138:13 138:13 pertinence 161:21 pertinent 150:8 212:24 pertinently 164:16 Peru 22:24 pervasive 176:12 pervasiveness 65:17 per-megawatt 58:1 PETER 2:14 phase 1:7 6:24 7:23 104:12 121:6 phases 118:9 Philippa 2:10 115:4 photograph 25:21 45:21 photovoltaic 92:5 physical 47:17 57:5 61:9 103:15 213:15 physics 66:8 pick 35:5 60:10 84:11 94:23 111:25 171:17 picked 96:20 97:14 129:15 168:10 171:14 picks 41:6 46:1,3 picture 16:9,18 55:7</p>	<p>98:2 215:3 pie 44:11 70:14 pieces 14:11 pier 189:3 195:14 piers 188:18 pinnacle 224:13 place 15:25 33:19 61:12 89:10 162:8 207:22 221:8 222:18 placed 56:14 117:13 117:22 places 26:9 plain 142:15 plainly 136:6 141:18 plan 57:1 73:2,4,6,12 74:4,19 114:10 143:11 217:8 planned 71:20 90:16 104:6 206:10 209:2 210:10 planner 99:21 planners 79:18 planning 58:19 63:18 69:11 71:23,24 73:15,23 74:8,14 75:2,8 76:6,13 77:19 88:19,21 89:3 89:12 98:8 109:1 111:25 113:7 115:5 209:6 215:10 plans 69:8 209:6 plants 5:6 12:23 13:3 13:4,5,7,10,13 24:18,19 42:13,21 49:15 51:1 55:9 56:13 57:14,15,18 57:19,25 58:12,14 63:19 68:17 71:15 73:3,9 74:16,19 77:21 79:13 83:6,11 86:16,21,22 87:15 87:19,22 88:6 90:8 90:8,10 91:13 93:17 93:18 94:5 100:9 101:9 102:1 103:11 103:22 104:19,20 106:24 124:13 126:1 130:17,19 132:9 136:13 138:3 144:7 153:7 154:17 156:4 158:2 159:2,9 175:10 190:16 191:18 197:16,22 197:24,24,25 217:25 218:7,10 220:11 222:17 plant-by-plant 7:11 222:1 plant-specific 128:24 134:23 151:12,24 152:19 159:24 160:16 161:12 platform 4:9 PLA-100 185:2 PLA-108 148:4 PLA-109 149:5 PLA-21 153:12</p>
--	--	---	---	---	---

<p>158:24 PLA-3 151:5 156:20 159:4 175:2 190:1 200:8 201:12 211:10 215:14 216:21 PLA-95 146:22 please 4:2 35:11 62:19 115:17 171:7 182:19 219:23 pleased 62:22 plus 44:9 47:5 61:18 pm 105:11 115:11,12 115:13 171:3,5 179:7 182:20 219:14 224:16 PO 116:17 117:6 119:24 podium 1:5 4:18 11:17 150:2 point 9:17 11:16 22:2 48:11 49:21 54:8 59:1 60:13 61:2,21 62:12 70:14 82:11 82:14,20 107:17 113:16 118:15 119:16 125:21 128:16 130:4 133:25 134:4,9 144:22,25 148:2 154:7,8 155:17 156:18 158:4,15 164:17 169:11 170:1 178:12 179:19 181:3 185:16 193:18 195:17 200:3,3,16 202:4 222:22 223:3 223:11 pointed 184:14 192:24 pointing 67:1 points 3:20 11:11 82:16 163:19 168:19 171:9 185:6 212:24 Pokhara 37:14 policy 73:17 79:22 110:18 134:15 pondage 26:13 28:12 28:14,15,15,17,19 29:2,9 42:22 56:9 75:13 76:25 77:12 84:25 85:7,10,15,17 87:25 88:1,13 101:6 101:10,10,14,15,21 102:13 104:22,22 104:25 105:19 106:10,12 107:10 107:12,18 109:14 112:9,13,19,22 119:1 124:20 128:14 129:14,20 130:2,23 192:22 193:1 196:22 198:1 198:6 199:6,12,14 199:18 201:22 pondering 221:11 pool 28:12,14,15,15</p>	<p>28:19 29:2 42:22 98:12 198:24 199:16 pools 98:14,16 poor 14:6 94:19 99:21 100:1 population 66:19 portion 27:18 34:18 60:1 posed 139:1 poses 114:5 posing 7:20 position 11:13 82:10 125:23 126:8 127:12 128:9 130:20 131:3,4 132:11,16,20,20 133:1,19,21 134:6,8 134:10,11,14 142:13 155:4 166:3 170:7 174:13 176:25 177:21 178:22 182:1 186:15 187:7 190:18,24 194:4 207:6 212:2 positions 82:21 120:8 124:23 125:9 127:11,16 130:11 131:15,25 132:2 positive 185:15 210:12 possibilities 32:9 possibility 21:3 60:20 167:23 169:18 171:22 possible 23:23 31:18 71:4 90:13 99:13 164:6 222:4 possibly 164:9 posture 133:9 post-Kishenganga 133:7 potential 14:3,23 54:1 54:16 57:12 80:5,10 80:13,17 163:25 165:11 166:1 191:17 194:19 217:9 potentially 118:21 146:9 150:14 powerhouse 34:6,9 35:5 56:18,19 61:8 PO6 120:20 137:11 PPA 46:25 practicable 204:24 practical 157:15 170:4 practically 175:13 188:25 200:11 practice 86:12 184:15 208:8 212:22 214:2 216:17,23 practices 3:2 14:6 136:12 175:3 211:24 212:3,4,17 213:23 214:12,12 214:17 215:24 216:1,5,8,15,16,25 218:24 221:4,6,14</p>	<p>221:18,24 preamble 135:19 208:3 217:16,17 precedent 176:23 177:4,14,18 precedential 120:11 123:4,8,15 124:2,5 125:12 130:15 131:10 132:17,22 132:23 133:14,19 134:2,12 136:19 177:22 precipitation 49:17 precise 127:4 133:3 184:6 195:16 precisely 4:5 7:1,9 85:3 223:19 preclude 155:21 precludes 143:4 precursors 13:7 predictability 126:23 151:2 162:3 163:2 predominantly 90:5 prefer 193:25 preference 58:10 196:4 preliminary 74:2,3 preparation 74:6 prepared 105:6 138:22 preparing 1:19 2:8 prescribe 212:7 prescribes 211:12 present 62:24 64:9,17 131:16 138:14,15 163:11 176:6 179:2 180:1 197:14 presentation 3:16 4:10 5:1 11:17,24 24:6 51:25 55:6 56:2 59:9 62:8 107:25 112:8 113:7 113:10,21 115:21 116:9 132:3 139:18 139:22 181:22 182:16 191:12 200:7 221:1 223:25 presentations 3:12 4:7 4:15 10:22 11:15 presented 4:3 87:7 105:15 176:7 223:18 presently 117:7 118:22 preservation 42:3 preserve 12:16 154:20 215:7 preserving 26:13 29:20 president 115:25 167:13 190:16 press 90:15 pressure 40:6 108:5 114:2 187:9 191:5 presumed 211:19 pretty 49:16 82:5 86:22 prevalent 93:22</p>	<p>prevent 137:22 prevented 162:16 previous 6:20 65:11 116:19 118:17,18 119:9 121:1,3,10 125:18 147:13 151:10 157:24 164:22 173:2 180:1 200:7 220:7 previously 33:2,4 43:3 71:4 175:8 pre-Covid 19:6 pre-feasibility 74:1 price 94:1 98:21 pricing 110:14,18 primacy 196:5 primarily 43:8 166:7 169:8 primary 64:8,10 81:8 169:8 190:2 205:18 principal 52:12 principle 126:24 143:6,7 144:17 146:19 147:1,9,15 161:21 166:22 167:2 186:1 189:21 190:6 194:8 principles 149:12 159:7 160:14,20 172:8 prior 11:12 13:2 143:11 169:20,22 priority 161:5,6 pristine 58:11 private 55:21 73:20 79:21 proactively 162:8 probabilistic 72:23 probably 17:10 25:22 29:25 35:23 42:9 49:9 53:20 58:12,15 60:3,12,16 222:12 224:1 problem 12:22,25 17:10 21:1,23 24:13 26:6 35:4,21 42:2 43:16 47:13 50:14 52:12,14 53:21,22 53:22 55:10,22 57:5 57:5 58:5 94:15 97:1,22 107:1 110:20 213:15,15 problems 25:1 37:9 45:6 46:25 50:2 51:2 55:5,11 57:6 62:1,5 109:5 Procedural 116:3,16 119:17 137:10 183:21 211:22 procedure 41:4 167:5 211:12 procedures 40:23 72:20 127:9 142:25 180:23 proceed 1:25 35:12 62:19 63:11 115:18 171:7,9 182:19 proceeded 151:25</p>	<p>152:13,18 proceeding 112:8,14 112:15,17 113:12 116:24 120:19 121:17 122:18 132:12 182:7,14 183:12 proceedings 4:25 5:22 118:9 119:8 120:25 137:15 138:14,15 138:16 142:3 143:5 143:9 146:21 156:7 176:8 179:2 proceeds 74:4 131:18 process 39:7 40:18 44:10,12 67:13 72:1 72:10,25 73:5,23,24 74:4,14 75:9 89:3 111:25 127:1 186:14 203:17,23 203:25 204:3 208:21 209:15 219:9 processes 2:22 produce 16:3,3,5 27:24 43:17 90:15 94:12 98:20 produced 1:23 67:19 68:6,13 72:7 75:21 76:10,22 81:12 85:23 96:24 99:12 producer 79:7 100:6 producers 73:18 103:13,18 produces 22:19 84:5 108:14 producing 22:25 72:16 92:22,23 product 66:2 production 46:23,24 47:10,11 65:19 66:7 72:15 76:12 77:25 94:19 107:4 191:7,9 220:12,14 profession 57:4 professional 50:21 Professor 1:10,12 2:10,11 3:25 2:23 8:11,21 9:6 10:17 10:19 51:21,24 54:7 56:21 57:10 59:5 105:10,13 106:5,7 107:21 114:13,20 150:2,12 170:21 171:14 182:17,19 182:22 191:20,24 192:19,24 206:6,7,8 206:11,13,15,17,24 207:4,8 219:16,24 220:2,3,4,14,17,20 220:22 221:17 222:25 223:21,24 profile 28:23 36:4,5 36:12,19 39:11,12 profoundly 174:21 programme 37:19 69:8 104:8 programmes 14:18</p>	<p>progress 51:12 191:2 progression 221:7 222:23 prohibit 33:20 207:17 212:10 prohibited 178:4 189:14 207:24 216:20 prohibition 6:8 44:23 154:15 155:11,13 155:24 156:1,9 157:1 184:12 188:14 prohibits 153:6 project 25:19,22 26:20 27:11 36:23 36:25 37:7,10,12 38:9,11,12,23 39:14 39:16,16 45:2,3,4 45:14 48:21 53:6,7 54:23,25 57:4 58:8 63:4 69:16 71:6,9 74:6 100:1 101:3 105:3 106:21 201:15 213:14 projects 27:7 33:14,15 33:15 35:15 48:13 48:14 50:17,22 54:21,21 55:15 62:25 69:11 71:4 72:15 85:1 87:17,24 89:4 90:25 92:13 93:14 97:9 102:16 130:6 131:18 215:10 prolonged 28:6 47:12 promised 186:25 promising 216:1 promote 209:21 210:14 prompt 116:7 proper 14:22 55:13,23 136:18 145:13 properly 3:11 7:22 12:4 properties 14:10 property 15:4 proportion 70:17 Proposal 186:25 187:4 proposed 42:18 116:22 129:19 151:19 190:15 215:16 propositions 222:19 propriety 211:15 protect 166:6 protection 44:8 45:9 204:18,22 205:3 215:9 protective 76:14 protects 203:14 protest 123:21 provide 3:17 4:9 5:13 63:9,22 66:5 68:21 69:9 73:20 83:7,25 84:24 85:1,16 91:14 91:20 96:14 99:21 99:22 100:1 102:18</p>
--	---	---	--	--	--

<p>104:11 123:2 166:25 169:4 202:5 210:9,12 214:20,23 provided 74:15 80:7 87:11 88:15 91:5 94:15 97:12 99:25 100:2,16,22 128:6 131:25 167:6 184:11 188:15 196:12 197:20,21 205:2,17 208:9 209:18 provides 70:20 85:7 99:1 104:8 119:25 141:3 189:7 196:20 203:9 204:21 208:11,22 209:1 providing 185:3 province 103:20 provision 10:5,13 70:22 83:11 100:20 102:6 104:10 107:18 154:2 167:8 167:22 187:13 188:5 189:11,15,16 195:1 197:7 203:11 203:14 204:19 205:18 209:11,24 provisions 79:19 128:14 136:6 139:7 140:11 141:4 144:3 144:8 180:18 183:15 187:4 188:4 189:23 193:7 197:3 197:19 202:21 210:25 proviso 157:10,20 174:2 préparatoires 9:17 190:5 public 44:10 73:20 214:15 pull 4:14 222:18 Pulp 215:14 pump 69:9,10 pumped 26:20 80:1 91:19 104:6,8,11 pumping 104:12 pumps 108:8 purchase 47:1 pure 56:8 144:19 147:23 purest 147:24 purported 129:8 purporting 136:5 purports 218:11 purpose 3:8,16 63:9 71:24 135:19 136:8 142:15 149:15 182:6 189:25 194:15,18 200:4,6 200:19 204:11,18 205:24 209:19 212:5 217:14 218:21 219:1 purposes 23:19 24:4 39:10 73:7 126:10 128:17 140:23</p>	<p>149:20 168:3 178:3 197:14,14 198:18 203:4,5,10 211:24 pursuant 1:1 119:13 173:4 198:19 199:3 pursuing 120:19 215:22 put 4:2 5:25 10:7 17:13 18:6 20:8 24:17 31:17 32:15 32:17 34:6,23 35:5 35:6 36:24 51:8 55:24 57:7 59:4 73:1 85:21 98:18 104:13 129:18 145:21 153:20 162:8,10 164:5 175:22 189:15 190:24 213:18 216:15 223:19 putative 135:18 putting 3:8 13:20 33:18 36:20 pyramid 1:18 2:8 11:1 P-0227 217:12 P-136 187:15 P-139 187:21 188:7 P-227 176:24 P-23 130:12 131:20 P-24 128:20 P-26 130:12 P-420 186:13 P-468 190:11 P-548 154:13 P-603 78:5 P-612 43:23 P-70 127:21</p> <hr/> <p style="text-align: center;">Q</p> <p>qualified 134:21,25 173:11 quality 60:7 78:3 128:22 132:7 142:1 151:11 quantity 46:4 186:5 quantum 203:18 quasi-precidential 120:12,16 126:9 questionable 135:14 questions 3:6,7,8,12 3:17,18,19,20,21,22 4:1,2,3 4:1,1,2 5:9 7:7,20 11:12 51:20 51:23,25 58:23,24 62:7 105:9,12 106:4 107:24 109:12 111:12 113:2,19 114:12,15,16 117:24 120:21,22 120:24 121:2 123:12 124:9 131:16 134:21 138:18,25 139:17 140:21,21 141:6 149:22,24 151:18 167:18 170:15,16 174:9 179:5,8</p>	<p>211:14 219:12,15 223:23 224:9 quick 36:22 45:1 171:9 quickly 40:1 47:19 78:17,21 87:20 107:3,16 quite 7:21 13:11 14:3 14:3,16 59:22 70:16 76:14 77:6 108:23 138:17,18 148:2 150:7 175:23 177:5 186:14 188:8 194:10 213:17 quotation 153:3 216:16 quote 131:14 quotes 131:24 quote-unquote 49:7</p> <hr/> <p style="text-align: center;">R</p> <p>radiation 94:17 Rae 2:14 3:11 2:13,16 4:17,18,21 5:16 62:12,19,22 105:7 105:13,22 106:6,15 107:23 108:6,25 109:23 111:16 112:5,6,23 113:15 113:20 rain 1:10 raise 171:22 raised 11:11 119:10 121:7 127:11 131:7 164:16 180:19,20 181:19 raising 21:22 ramp 84:19 range 18:5 30:7 59:20 65:17 67:12 214:24 215:2 rapid 30:24 64:17 66:15,17 rapidly 40:5 65:23 67:2 84:19 94:21 106:16 rate 39:23,24 40:8 41:13,16 47:18 75:5 76:10,11,24 77:13 81:2,4,5,6,10,24 82:17 83:16 84:18 88:2 96:9 108:3,15 108:16 rated 83:19 rates 14:8,10 rather 4:4,19,23 12:7 27:8 36:14 41:1 47:12 49:19 53:21 57:18 104:18 114:4 115:5 145:8 164:11 176:25 rationale 148:21,25 149:4 159:11 161:14 177:15 Ratle 117:20 218:8 Raymond 6:1 reach 8:8 18:4 20:4 62:3 194:13</p>	<p>reached 137:20 145:24 reaches 158:7 reaching 137:23 158:6 react 78:17 82:19 84:11 95:9,17 97:1 107:7,7 reacting 85:10 reactions 223:2 read 54:19 78:9 119:20 138:22 143:19 165:9,14 175:7 183:25 193:2 197:7 202:4 205:19 221:9 reading 133:12 reads 188:14 217:16 ready 1:25 56:13 62:19 115:17,21 171:7 real 21:7 44:25 65:1 216:17 realise 95:22 Realistically 20:7 reality 162:11 163:6 164:9,21,24 218:13 realized 175:23 really 15:6 16:2 18:18 24:17 25:11 26:15 30:2 32:22 33:7 42:6 49:2 51:4 55:24 57:22 58:16 100:8 112:3 126:8 158:5 163:7 164:14 186:10 realm 13:9 reanalysed 21:10 reason 6:25 7:8 12:2 reasonable 107:18 reasoning 129:7 139:5 139:14 145:1 146:13 148:16 150:8 161:17 162:10 163:5,6 164:8,20,23 171:11 221:7 222:24 reasons 3:24 4:3 8:4 37:10 43:19 61:1,3 120:7 141:13 143:19,21 145:8,10 145:15,19 164:4 reassembled 62:18 171:6 reassembling 115:15 reassessment 219:8 recall 5:9 7:2 8:16 59:12 67:17 76:17 82:23 101:23 127:3 161:22 212:24 recap 116:15 receive 50:7 53:8 183:2 recent 19:5,5,6 51:12 63:6 64:25 67:7 90:14 103:4 145:4 recently 65:22,23 97:20 148:3 reciprocal 186:24</p>	<p>recognise 74:12 88:13 recognised 126:24 158:19 174:15 recognising 157:12 recognition 147:20 150:18 164:6 reconsider 166:9 reconsideration 162:9 163:5 166:11 reconvene 114:3 record 12:5 43:24 119:21 123:3 126:6 127:4,10,19 132:12 133:5,12,23,25 154:24 162:6 182:10 recount 122:24 recur 131:17 red 122:8,13 139:12 redesigned 201:7 reduce 13:16 154:20 reduced 53:25 reduces 82:15 reducing 13:22 14:14 14:20 reduction 60:17 90:20 152:11 Rees-Evans 2:12 9:16 186:7 187:8 190:7 Rees-Evans's 217:23 refer 67:18 76:18 146:5 156:3 167:22 167:25 183:19 207:11 215:24 220:13 reference 87:7,11 93:17 120:15 129:9 139:9 142:11 148:15 149:14 158:22 160:21 171:12,13 184:9 191:6 205:3 208:10 212:12,15 213:12 221:23 referred 78:11 89:17 91:19 117:14 124:14 177:17 178:18 215:20 referring 74:10 206:2 refers 89:20 169:18 185:2 208:3 refill 29:9 40:12 reflect 75:2 112:24 183:17 198:13 200:5,14 202:22 223:21 reflected 139:15 179:24 reflecting 5:3 113:9 192:11 reflections 24:2 reflects 189:24,25 209:11 218:23 reformatted 44:15 refuting 120:10 regard 5:10 6:8 10:6 109:13,17,18 113:23 114:3</p>	<p>122:20,22 136:21 140:12 143:23 183:19 194:2 regarded 181:6,13 regarding 216:2 regardless 37:15 regards 122:16 123:9 123:9,25 124:4 125:15 133:19 141:16 142:12 145:25 154:10 156:6,7 158:10 160:3,5 166:18 168:18 175:1 181:10 201:22 regime-type 43:7 region 54:15 70:9,12 70:15 regional 69:20,21 70:13 98:11,14,15 regionally 71:13 regular 51:7 regulate 78:13,14 regulated 192:16 222:9,14 regulating 200:15 regulatory 40:25 43:22 45:10 47:21 57:6 155:14,19 175:9 213:16 216:19 rehabilitation 19:7 reinforce 195:2 196:25 202:17 reinforces 70:21 reinforcing 184:20 reinterpret 49:7 reintroduce 17:1 reiterated 161:21 reiterating 130:13 rejected 6:13 129:8 130:9 136:9,17 151:24 174:24 177:20,25 rejects 131:16 rejoinder 113:3 176:21 177:8 217:11 relate 105:14 165:19 191:13 related 59:10 90:6 105:1 117:4 119:1 123:12 124:9,20,20 124:21,21 131:15 137:5 144:6 151:6 160:1 171:11 relates 52:1 54:8 192:22 relating 118:10 141:2 141:6 152:1 160:23 167:18 181:18 184:25 208:23 relation 128:3 129:24 131:5,10 135:6,23 139:1 141:18 145:5 151:23 152:5 153:22 161:1 171:19 182:8</p>
--	---	--	--	---	---

<p>217:21 relations 147:6 150:23 relationship 154:3 183:14 191:14 193:6,8 195:3 197:1 197:2 208:1 relative 65:20 69:14 relatively 64:25 114:24 169:10 203:2 224:2 release 24:24 30:14,20 31:2 40:21 41:18 42:12 47:14,25 54:4 77:13 202:14 released 30:3,3,14,17 30:25 53:4,12 161:24 releases 27:2 42:16 releasing 24:20,23 33:3 40:14 relevance 23:18,22,23 24:3 112:18 122:21 123:4 166:4 relevant 25:4 47:22 63:10 124:15 125:7 144:11 148:4 151:6 172:9 175:20 185:19,23 197:14 204:10,15 reliability 76:5,7 90:23 reliably 74:15 reliance 128:16 130:22 133:1 177:3 relied 124:24 relies 128:10 207:25 relieve 219:25 relitigating 169:18,23 relitigation 171:23 rely 120:18 125:17 176:22 194:11 204:9 216:1 remain 29:21 30:6 42:14 89:2 147:9 remainder 139:18 remaining 19:7 198:24 remains 120:3,6 remarks 7:17 90:5 105:6 116:13 139:24 remedial 20:1 51:1 remember 27:3 29:23 31:22 34:13 54:24 59:20 93:15 remit 75:10 191:11 remote 71:6,10 Removal 13:24 remove 13:17 40:10 removed 75:9 204:12 render 126:17 173:25 rendered 118:19 140:10 143:16 144:2 152:6 rendering 157:22 renewable 5:10 64:1 65:25 67:7 70:22</p>	<p>89:16,19,25 90:21 92:2 96:22 100:15 103:6 renewables 67:10 68:23 89:17 102:22 106:9 renvoi 10:12 reopen 165:11 166:17 167:1 reopened 146:4,6 reorganising 88:22 repair 35:24 47:19 repeat 181:15 repeatedly 51:2 119:3 119:5 132:17 136:14 153:10 replace 100:13 102:21 105:4 replaced 70:6 103:23 185:13 replacement 23:11 replan 58:21 replicated 218:10 report 78:4 196:6 reporting 183:17 208:2 210:4 reports 90:15 repose 36:17,17 represent 72:21 REPRESENTED 2:16 reproduced 78:3 87:4 REPUBLIC 1:16,18 2:2,16 repugnant 187:3 request 132:14 153:11 153:13,16 154:12 155:1,8,9 159:23 190:21 208:23 requested 151:25 154:19 175:18 209:7 210:10 214:22 require 47:9,11 64:3 83:12 90:21,25 103:25 147:7 203:6 203:19,21 212:9 required 69:2 84:20 86:17 88:3 105:4 155:24 158:16 199:21 211:2 213:11 214:12 215:6 216:3 requirement 33:23 73:18 84:18 95:5 215:8 218:4 221:19 requirements 81:23 141:11 183:17 192:20 198:9 208:2 208:7 210:5 211:25 216:24 221:15,21 requires 29:15 96:12 138:7,11 207:14 218:24 res 126:23 142:6,13 143:2,6,22 144:17 144:19,25 145:3,18 145:20 146:8,16,19</p>	<p>147:1,3,18,24 148:6 148:14,24 149:2,4 149:22 150:21 156:10 157:9,13,23 158:5,7,15 161:19 161:22 162:2,14,18 162:18 163:23 164:7,12,20 165:11 165:22 166:2,5 172:4,25 173:2 174:1 177:6 180:8 reschedule 77:3 reserve 78:16,16 84:1 84:7,8,13 86:18,18 95:17 99:3,10 100:25 reserves 78:18 91:11 reservoir 12:16,20 14:19 25:10,17 26:5 26:22,24 27:16 28:12,20 30:10,12 30:15,24 31:5,16,25 32:1 34:11,12,15,19 34:21 38:24 39:5,8 39:22 40:2,4,7,9,12 41:5,17 42:7 43:14 45:14 47:7 80:11 93:9,10 129:3 152:14,21,22 198:18,25 199:4,13 201:2,8 202:13 reservoirs 12:19,25 15:14,22 18:14 20:13 22:5,14 25:4 25:12,19 26:15,16 42:10,13 43:8,11 54:15 91:14 152:12 206:4 216:8,19 resistant 216:16 resolution 119:12,15 126:16,20,21 127:1 127:9 135:9 137:14 142:18,25 176:11 211:14 resolve 124:11,17 134:21 135:5 142:5 142:23 144:9,13 149:15 191:4 resolved 174:18 180:17 211:9 resolves 142:17 resolving 149:17 173:22 175:4 resorting 75:7 resource 17:10 101:1 resources 2:4 5:11 63:7,8 70:25 72:7 79:4,18 90:18,21 91:7 97:5 106:25 185:1 215:19 respect 9:25 24:15 59:23,25 63:22 71:12 99:3 110:11 116:25 117:3,16 119:1 120:13 123:1 124:13,23 126:1 127:13,25 128:9,23 129:12 130:17,23</p>	<p>132:7,8 137:1,18,22 137:24 139:11,19 140:13 144:4 151:12,13 153:17 156:8,22 157:17,25 160:12 164:9,12 170:13 172:19 174:1,16 176:7 178:9,24 179:1,1 180:4 212:14 respected 216:11 respective 131:25 132:2 134:12 respond 6:18 86:14 113:2 116:2 responded 216:10 responding 2:19 response 3:14 115:24 138:4 188:21 190:24 223:20,20 responses 116:12 rest 114:10 121:6 145:15 restart 40:12 restoration 14:5 restraints 216:17 restrict 207:15 restricted 130:25 176:2 178:22 198:2 restrictions 186:3 201:25 218:13 restrictive 193:22 194:11 restrictively 194:9 218:19 restricts 197:10 result 54:17 162:6 164:24 165:7 166:7 183:3 resume 62:12 171:1 224:3 retained 26:5 retroactive 162:16,21 retrospective 157:15 175:17 retrospectively 158:2 159:9 return 2:16 5:16 7:12 8:11 11:16 62:11 160:7 164:17 165:19 204:5 219:17 returned 204:13 returns 91:22 review 44:10 119:18 reviewed 113:16 165:7 revised 201:10 revising 39:14 revision 219:8 revisit 3:18 revisiting 11:11 revisit/reconsider 165:20 revolutions 64:15 re-examine 182:12 re-litigation 143:4 RHEP 123:2 125:13</p>	<p>136:16 Rhine 215:20 richness 47:24 right 9:1,10,10,21,23 9:25 10:1,4,6,10,11 10:13,15 26:2 32:13 45:19 64:23 67:22 68:7 93:20,25 108:24 109:22 180:25 185:9 186:20 187:11,21 189:12 191:20,20 195:9 196:19 206:12 222:20 224:6 rights 151:3 208:12,13 208:14 210:11 217:20 222:4 223:3 right-hand 43:4 73:1 83:14 riparian 186:17 RIPPIN 2:13 risk 54:16 55:25 56:24 61:22 62:4 117:2 215:16 risks 56:25 61:23 137:15 river 16:22 19:9,23 24:1 26:21 28:12,20 30:17,20 31:8,11,12 31:12,20,21,21,22 34:22 36:25 38:12 38:17,21 40:15 41:5 41:21 47:23 52:11 54:23 56:15 58:6,11 58:14,18,19 61:6,16 70:10 81:10 88:1 129:24 161:24 165:9 166:8,9 185:1 185:4 204:5 206:12 210:13 215:4 riverbed 31:1 53:13 53:18 rivers 3:23 2:24 8:14 9:2,22 31:8 37:2 38:21 58:20 120:15 123:10,21 124:7 126:4 128:2,25 129:6,25 130:7 131:19 138:3 151:14,21 152:15 153:3,8 154:22 155:13 156:24 157:2 158:3 161:6,7 166:19 178:2,5,11 182:21,24 183:3,9 183:24 184:13 185:13,22,25 186:2 186:6,20,21,23 189:13 190:4,13,19 195:11,12,21 196:15 197:12 200:18 203:24 204:3 205:1,9 207:18 208:24 209:4 210:17 217:10 218:1 221:23</p>	<p>riverside 62:2 river-specific 202:6 RL 190:22 road 14:25 roadmap 2:6 roadmaps 1:17 rock 40:3 role 63:7 83:8 102:2,3 102:4,16 120:12,16 123:11 142:12 168:23 188:2 214:4 223:14 roller 38:5 roof 94:23 rooftop 96:19 room 82:23 84:9 rotating 82:9 rotational 80:22 rotor 80:23 roughly 170:24 round 6:17 18:18 25:12 roundly 177:20 route 13:16 routing 13:23 25:8 28:25 rows 79:2 rule 8:18,25 9:9 38:15 39:6,14 147:5 183:13 187:25 189:5 193:9,14,16 194:8,13,21,25 196:4 202:1,17,22 217:5 218:17,19 rules 160:13 166:17 167:14 196:12 rule-exception 195:3 197:1 208:1 ruling 131:8 rulings 119:3 153:2 156:22,23 run 18:9,13,25 30:1 36:5,7 37:15 99:20 114:21 129:24 running 22:24 52:23 60:8 99:11 201:5 runs 207:12 run-of-river 3:3,9,23 2:14,24 3:22 5:1,6 8:14 12:12,23 13:3 13:5,7,13 42:21 55:9 56:9 62:20,25 63:3,21 79:25 84:3 87:24 88:15 91:15 93:10 95:21,22,24 96:5,7 98:7 99:14 99:17 100:1,6,9 102:1,9 105:3 128:2 129:5 152:15 153:7 154:17 158:2 159:2 182:21,24 192:8 196:21,24 197:16 197:24,25 198:3 199:20 201:10,20 207:5,9 220:11</p>
---	---	---	--	--	--

S

s 128:13

<p>sake 64:8 96:21 Salal 53:6,7 sale 47:2 salient 139:23 salmon 48:3 same 10:13 24:16 36:12,13 42:11 46:1 61:5 66:8,25 75:17 76:15,19 90:23 93:17 101:22,24 107:3 116:18 117:1 117:3,21 129:17 130:5 137:8 138:11 142:20 143:4,5 149:18 159:25 171:23 174:7 189:15,16 201:10 204:5 sanction 147:3 sand 18:3,3,7 30:25 35:19 36:16 38:2,3 38:24 46:3 sanitation 203:3 Sanmenxia 30:19 satisfaction 219:20 satisfy 71:25 Saturday 224:10 Sauerman 45:22 save 174:2 180:4 197:10 saw 1:10 34:13 158:18 158:21 162:16 166:19 176:20 saying 2:4 7:4 48:21 51:16 107:15 144:25 145:9 146:11,20 148:1 165:21,24 170:14 175:10 177:9,21 211:11 214:12 says 9:22 32:14 33:10 44:15 46:17 143:3 143:18 164:14 171:25 186:16 189:17 195:21 197:18 206:21 223:8 scale 39:2 46:19 65:2 scar 16:5 scars 16:4 scenarios 52:8 schedule 86:16 87:18 scheduled 77:1 85:18 86:19 scheduling 86:21 schematically 41:4 scheme 53:2 204:22 204:25 221:6 223:18 SCHOFIELD 2:19 school 51:5 Schwebel 167:13 scope 125:2,16 148:6 152:25 153:17 178:18 181:11,23 184:24 214:4,10,17 222:13 scour 21:14 33:4</p>	<p>36:14 scouring 33:2 screen 138:6 163:22 190:11 203:2 209:1 scripted 7:17 sea 19:4,10 SEAN 1:10 season 28:6,11 29:2,4 29:8 30:4 38:18,19 39:8 84:5 87:2,2 88:5,8 99:18,19,25 100:3,12,19 102:20 201:2 seasonal 91:14 104:4 108:20 seasonally 84:4 102:6 102:18 seasons 87:13,13 SEBASTIAN 2:20 second 4:9 18:5,6 30:2 41:12 52:14 61:20 81:12 106:8 118:15 119:9 120:18 125:7 126:13 139:20 152:5,25 153:25 154:8 162:13 178:23 183:14 184:5 195:7 204:1 204:19 216:4 217:17 220:9,13 221:21 secondary 31:2 78:12 secondly 139:3 151:19 162:21 seconds 95:12 second-round 170:17 Secretariat 11:22 12:3 Secretary 2:7,8,19 section 48:9 62:3 63:25 92:4 135:22 135:22 sections 193:8 sector 90:14 secure 7:13 186:22 219:10 sedimentation 26:7 34:24 sediments 13:16,23,24 33:2,4 40:10 43:8 53:17 sediment-guided 29:22 37:21 sediment-laden 26:12 see 1:3,5 13:6 14:5,9 14:16 16:24 26:2,25 29:1 37:22 39:20 43:6 45:18 49:2 51:2 59:24 60:1,10 64:10,23 65:25 67:6 70:18 71:13 79:5 87:2 92:18 93:14 95:7 97:22 98:13 103:19 105:8 108:17 111:16,17 112:17,24 115:7,10 115:15 118:23 126:5 128:8 129:15 129:17 132:11</p>	<p>133:3 138:6 142:14 145:6 151:7 153:3 154:11 159:11 165:24 169:23 176:23 187:16,20 193:12 197:7 202:21 203:1 204:4 205:15 221:7 224:14 seeing 101:16 107:18 146:17 seek 72:21 seemed 112:17 seems 23:22 49:22 53:10 112:14 114:1 143:21 164:11 169:20 221:12 seen 15:25 28:1 30:19 35:14 38:21 45:13 53:13 66:15 82:3 117:8 136:14 149:11 155:7 175:17 177:20 213:23 segment 58:18 seised 142:19 seismic 15:16 16:8 20:23 213:16 select 58:12 63:19 86:13 selected 76:7 selecting 72:10 selection 47:15 73:8 selectively 103:10 self-denying 3:25 170:19 224:8 self-propagating 21:19 self-standing 10:4 194:25 196:10 seminal 146:22,25 semi-detached 10:16 Senior 2:21 sense 62:1 78:9 85:10 113:1 114:9 134:14 147:23,24 163:7 168:20 177:16 senses 108:7 sensitivity 47:22 48:6 94:1 215:3 sensor 82:8 sent 7:3 separate 156:14 171:11 193:4 205:19 separately 189:16 September 127:21 186:13 187:7,12 sequence 221:13 sequential 116:22 series 25:19 64:15 97:5 118:10 152:1 160:9 202:5 serve 70:4 129:23 serves 136:25 service 42:10,14 44:8 services 63:22 78:6,11 78:12 79:7,12,15,17</p>	<p>79:19,24 83:9,11,21 83:25 84:6 85:17 94:10 100:16,21,24 101:8 102:2,5,19 103:10 104:10,11 session 5:12 set 49:23 82:11,13,16 82:20 84:18 139:5 148:16 154:15 163:4 166:18 175:9 185:24 193:15 194:4 195:22 196:9 196:16 197:6 206:20 210:20 211:25 217:7 sets 82:2 202:1 206:3 setting 11:20 161:23 205:8 settle 131:9 settled 7:8 129:2 147:5 180:17 settlement 2:22 149:12 settles 30:17,18 settling 116:24 seven 134:19 165:18 178:8 seven-day 112:18 seven-member 136:2 seven-page 135:22 several 37:11 60:17 69:11 severe 16:1 17:10 severely 55:8 205:21 SHAH 2:4 shaking 21:18 shape 109:10 111:10 shared 98:12 215:19 sharing 208:20 sharp 114:23,25 shelf 111:13 148:3 shift 98:4 101:17 187:22 short 34:10 40:22 62:16 77:7 123:6 150:18 171:4 176:16,19 shortcuts 86:24 shortened 115:3 shortening 111:13 shorter 77:3 115:5,8 shorthand 117:17 shortly 3:23 120:16 127:8 142:8 160:7 short-term 91:17 95:13 96:16 97:25 shoulders 7:22 show 69:20 76:11 77:20,22 79:2 86:8 91:25 103:5 122:4 137:20 189:3 212:19 213:25 showed 50:19 200:6 217:15 220:6 showing 88:23 93:18 189:9 shown 64:22 65:11 67:10,21 69:20</p>	<p>83:14 195:13 shows 13:15 24:9 25:5 64:14,22 66:17,24 69:23 78:10 85:24 87:8,9 92:1,9 94:1 96:22 122:7 shrink 170:10 shut 103:21 109:8 shutdown 29:8 47:12 shuts 95:16 shying 177:18 side 56:7 64:24 65:6 68:10 73:1,1 79:2 83:14,16 94:16 183:7 187:17 190:11 sides 40:7 sight 11:3,6 224:12 signed 141:13,15 significance 145:6 168:3,11 182:13 significant 15:18,20 30:21 35:21 60:4 64:3 65:12,24 87:8 87:9,12 117:15 118:20 162:24 187:24 203:6,6 215:17,21 217:9 significantly 64:19 94:20 162:5 silt 16:16 silty 43:8 similar 49:10 50:2 64:22 70:18 94:24 98:2 102:17 166:22 167:2,9 similarly 65:15 82:14 177:8 simple 139:8 141:12 simplification 75:6 simplified 82:8 88:22 simplifies 75:4 simplify 72:25 88:20 178:17 simplistic 71:22 81:18 simply 4:23 6:11 80:10 81:5,14 101:15 133:15 142:24 145:15 165:17 195:20 simulated 59:16 simulations 32:20 simultaneously 116:17 since 22:3 45:15 49:9 119:1 149:25 194:7 206:25 single 8:7 70:4 87:3 104:15 134:24 Sir 2:9 3:2 1:5,7,8,14 1:24 2:1 11:9,19 62:13 106:3 112:6 113:24 114:7 115:2 115:9 155:17 170:2 170:3 171:2 193:19 193:19 194:12 196:3 224:1,5,15 site 3:20 5:5,9 32:6</p>	<p>33:24 34:3,9 35:5 47:16,17 58:19 104:25 209:16 212:15 213:20 214:9 215:1 sites 57:8 154:22 155:16 sits 198:23 situated 90:4,7 situation 25:25 66:14 78:24 137:25 148:18 163:11 165:13 171:24 172:3 179:24 180:4 situations 169:3 six 88:11 161:2 210:1 size 31:12 58:12 70:18 122:5 212:12 sketched 106:9 skilled 135:2 skill-set 134:15 skin 8:13 50:14 slice 89:5,6,7 slides 56:1 67:6 127:15 slightly 115:3 128:9 slope 20:17 21:11,15 47:23 109:3,4 slopes 21:12,17 slowly 65:20 slug 24:23 30:9 sluice 34:6 39:10 56:8 sluicing 25:14 27:15 28:1 29:1,14,21 31:7,17,25 32:12,15 32:16,23,24 33:3,8 33:13,15 35:14,22 36:2,23 38:13 39:7 43:25 44:13,15,21 44:21 46:22 47:10 50:15 51:10 216:10 small 8:5 16:19 19:15 26:22 31:19,21,24 34:5,11,18,23 36:24 36:24,25 45:4 55:9 70:5,16 85:6 86:22 94:22 99:6 109:7 169:10 206:5 smaller 16:21 26:15 31:25 39:16 57:15 57:19 68:24 109:6 167:18 201:13 Smelter 146:25 147:11,12 smelting 203:7 social 45:6,7 48:6 socioeconomic 47:20 Société 147:18 soil 14:7 40:3 solar 5:8 22:23 63:6 68:11,11,19 69:1,3 69:6,10 72:8 79:8,9 79:18 84:21,22 89:20,24 90:4,5,7 90:11,12,15,17,19 90:24 92:5,6,7,9,20 92:22 93:2 94:12,17 94:19,22 95:2,4</p>
---	---	---	---	--	--

<p>96:24 97:25 98:3,10 98:20,22 99:2,12,18 100:7,22 101:7,22 102:17 103:24,25 106:23 107:8 solar-hydro 98:18 sole 218:15 solution 21:1 solutions 57:8 213:19 solve 51:8 solved 42:2 solving 50:11 some 3:18 6:6 7:20 11:11 13:15 21:15 23:25 27:20 28:16 29:23 33:5,14,14,15 40:14 45:7 46:6 53:18 54:19,20,21 62:24 63:17,23 65:22 67:4 68:3,3,4 69:3 71:4,19 73:15 79:15 80:2 83:11 84:7,10,24 85:24 86:24 87:9,16 88:8 90:6,20 91:17 94:2 94:18 95:13 96:11 97:14 98:4,10,18 100:3,11,12,18 101:9 102:6,7,19 104:5 109:15 111:12 112:23,24 113:1,2,16 114:15 114:21 116:9 120:22 125:5 135:5 135:14 137:4 138:20 139:24 144:21 146:23 150:5 158:8 159:3 159:13 165:18 179:19 181:3,3 191:15 194:2 198:12 203:7 222:21 somehow 12:6 112:3 165:22 someone 2:2 12:22 191:22 something 12:18 13:21 20:4,8 27:13 31:5 32:6 33:7 46:5 46:8,12 51:4,7 59:3 59:20 60:1,12,23 96:12 103:7 138:21 143:20 189:1 221:11 222:2 sometimes 8:5 83:6 207:24 221:21 somewhat 102:11 somewhere 10:16 84:11 100:23 soon 38:16 Sorry 106:6 sort 12:5 86:15 110:25 111:2 115:2 sorts 99:9 sought 177:3 186:23 sound 157:11 177:14 213:12</p>	<p>sounds 22:15 133:11 source 23:6 67:16 79:23 89:18 92:13 92:25 sources 64:2,2,23 65:20,25 68:20 89:16 91:25 92:2 95:4 96:22 97:17 103:6 212:21 221:6 221:14 222:22 South 27:20 southern 69:23 94:23 so-called 203:4 205:5 212:21 213:22 214:2 space 21:6 199:18 span 65:8 spawning 47:25,25 48:1 speak 11:25 40:5 62:23 speakers 112:7 speaking 12:7 31:13 90:4 133:8 217:17 speaks 191:17 special 45:7 102:12 198:13,25 199:7 specialis 168:21 specific 55:16 75:3 118:4 124:3,14 128:1 130:16 131:2 135:6,24 137:4,22 144:7 152:2 157:25 165:8,12,12 166:8 168:20 172:25 173:1 176:3 181:19 182:8 202:8 221:15 221:19 specifically 96:14 112:16 135:22 172:20 192:14 193:5 specifications 192:7 specifics 63:15 specified 191:15 spectrum 49:13 50:18 speed 80:20,22 81:1 82:9,10,13,19 108:3 108:7,10,16 spend 19:20 125:5 138:18 178:14 spending 199:6 spent 159:13 spike 52:25 spikes 95:7,11 spillway 18:7,8 36:10 36:11,13 56:6,11 178:2 212:8 222:2 spillways 18:4 124:21 201:23 spin 80:20 spinning 78:15 80:24 84:1,7,8,13 86:17 95:17 99:3,9 100:25 spins 81:1 spirit 208:4 217:19 223:14 spirits 2:1</p>	<p>spoke 188:2 215:21 spot 59:2 spread 27:23 spring 191:2 square 16:6 18:20 squarely 174:23 Sri 20:24 stabilise 21:25 stabilised 39:13 stability 19:21 40:2 150:23 151:2 162:3 163:2 stable 219:9 stack 77:21 89:4 stage 58:19 183:19 186:19 211:3 stair 61:7 stand 11:8 standard 218:9 standby 78:18 86:18 standpoint 60:14,15 stands 1:15 2:4 start 12:15 31:19 78:19,22,24,24 86:22 107:19 110:5 183:22 209:14 224:11 started 20:10 22:16 45:12 51:14 64:16 65:22 starting 10:21 11:1 109:24 118:10 144:22 185:16 starts 31:14 38:17 64:18 205:22 state 44:5 90:16 96:20 97:6,20 215:11 218:14 stated 73:11 128:4 129:10,21 176:22 190:1 213:21 217:10 statement 4:4 116:20 116:21 133:24 134:1 141:13 143:19 145:8,9,15 188:8 statements 127:22 182:5 states 14:15 44:1 60:7 78:5 93:20 98:15 109:20 110:21 167:11 215:8 state-of-the-art 136:11 218:11 station 72:23 74:16 75:24 76:2,23 77:16 84:10 99:11 104:17 stationary 80:24 stations 60:8 69:15,25 71:20,25 72:12 73:12,25 74:21 75:22 76:9 81:20 86:13 91:10 189:18 stator 80:23 status 120:25 121:3 122:21 124:2,6 125:2,16 127:13</p>	<p>131:10 147:15 statute 149:8,14,19 168:2 steam 79:14 93:21 steel 51:6 steep 36:14,15,15 109:7 steeper 111:21 steer 220:2 stem 61:17,18 step 7:17 60:22 61:7 72:14 73:7,7 74:22 Stephen 2:11 114:11 115:4 stepped 155:4 stepping 210:3 steps 221:13 stick 189:20 still 21:2 23:5 27:24 45:11 66:5 73:19 93:22 94:18 96:12 102:9,9 133:1 170:6 170:13 209:14 216:24 222:10 stop 1:11 17:21 39:21 stopped 176:16,19 storages 100:14 105:4 store 19:14 95:23 96:4 101:20 198:1 201:1 202:13 205:16 stored 91:12 198:17 201:5 storing 69:3 111:9 straightforward 59:6 101:18 strategies 13:8,15,18 25:6 strategy 25:2 26:8,8 26:15 27:15 28:7 47:16 strayed 136:5 stream 44:16 88:16 205:25 stressed 170:8 strict 173:3 183:24 188:13 189:4 192:10,11 195:13 196:15 205:8 strictly 172:1 strikes 23:20 strikingly 167:9 strong 190:24 struck 219:4 structure 3:9,11 44:18 110:12 structures 44:15 110:14 structuring 73:17 stuck 215:12 studied 179:10 studies 37:11 39:11 74:1,5 study 21:8 107:12 223:1 studying 22:16 stuff 30:22 114:21 subject 9:4,12,24 10:1 29:22 83:13 87:25</p>	<p>141:4 143:4 174:11 183:24 189:22 193:16 196:10 197:18 206:19 208:13,15 210:6 submerged 36:17 submission 116:19 125:5 134:5 151:11 171:17 177:19 178:12,16 179:6 submissions 3:13,23 1:15 2:5,10,12 3:7 5:17 6:22 114:12,15 114:20 115:23 153:22 163:16 170:18 173:2 182:21 219:11 submitted 149:9 153:17 subparagraph 188:24 204:2 subparagraphs 173:8 subsections 122:23 subsequent 119:14 142:2 153:11 158:20,23 163:13 181:13 subsequently 171:17 174:23 substance 129:8 178:14 substantial 52:9 56:24 substantially 203:25 substantive 116:12 successful 14:4,20 53:2 successfully 13:2,8 suction 45:18 sudden 52:24 sufficient 71:5 73:19 199:8 215:2 sufficiently 119:19 214:13 suggested 5:2 193:24 suited 98:23 SULJUK 2:6 sum 81:14 177:24 summarise 102:25 127:16 summarised 73:23 139:15 152:3 176:9 summarising 138:24 summer 39:9 summit 11:3,3 superficial 136:7 superficially 102:24 superseded 163:13 supervise 211:7 supplies 37:13 supply 52:13,22 53:23 54:2 70:1 72:11 73:21 78:3 87:16 94:7 109:19 208:23 209:7 supplying 88:6 support 99:2 110:5 supporting 37:16 supports 64:3 70:22</p>	<p>supposed 211:6 Surcharge 198:7 199:16 sure 12:4 23:17 73:5 99:4 109:15 119:19 139:16 150:15 170:21 207:3 surface 16:7 36:4 37:8 38:13 surplus 85:8 95:19 96:3 98:5 surpluses 104:10 surrounding 40:3 Survey 60:7 survive 1:9 suspended 26:18 27:6 27:8 35:17 59:25 sustainability 216:8 sustained 41:21 sustaining 50:4 219:2 swings 94:20 switch 84:9 switches 84:13 switching 52:6 switchyard 56:14,15 Switzerland 216:9 SYED 2:4 system 3:10 2:15 5:2 18:13 52:23 61:6 62:21 63:1,4,14,16 63:18,20,23 64:3,6 66:2 67:21 68:2,6 68:12,16,18,25 69:13,19,25 70:16 70:21,23 71:1,14 72:17,22 73:22 74:19,22,23,24 75:20 76:1 78:5,15 78:17,23 81:23 82:1 82:7,12,19 83:2,4 84:2,10,11 85:5,9 85:11,12,14,17,20 86:1,12,14,20 87:4 87:15 89:25 91:1 93:13 94:8 96:12,23 97:1 98:3,4,8,9,22 98:24 99:5,22 100:10 101:2,4,6,11 102:10 103:24 104:14,18 105:5 108:8 110:7 111:22 112:11 150:24 211:19 215:4 systemic 3:14 2:18 6:7 6:11,14 7:8,14,24 7:25 8:8 115:23 116:1 121:6 123:12 123:13 124:10 134:23 135:7 157:10,22 173:18 174:25 176:13 systems 63:3,5,24 64:1 66:5 69:2 70:4 70:6,7 78:1,7 80:15 82:18 84:21,23 89:23 96:15 103:18 107:19 109:6</p>
---	---	---	--	---	--

<p style="text-align: center;">T</p> <p>tab 116:8 138:24</p> <p>table 4:19 50:19 207:1 220:5</p> <p>tabs 116:6</p> <p>tacit 142:11,13</p> <p>tacitly 142:9</p> <p>tailored 199:2</p> <p>tailwater 61:8 80:12</p> <p>Taiwan 16:1 27:21</p> <p>take 3:5 20:7 38:18 39:18 42:8 62:10,12 77:1 86:1,3 89:9 96:3 110:1 114:13 114:16 116:8 119:16 126:6 127:15 135:13 136:11 139:5,6,14 146:11 156:13 158:15 170:2,23 182:17 203:19,20 215:8 217:4 219:12 221:7</p> <p>taken 7:6 92:1 113:22 127:16 130:11 132:8 186:7 196:11 207:21,22 210:22 211:24 212:3,18 213:2 214:14</p> <p>takes 22:8 40:18 150:2 163:16 174:3 208:2</p> <p>taking 24:1,22 37:19 42:13 46:22 86:4 101:16 124:23 125:22 128:8 144:20 145:4 178:13 207:16</p> <p>talk 17:4,4,5 22:3 42:3 44:25 91:18 98:17 101:7 107:6 109:13 132:6 175:8</p> <p>talked 112:9</p> <p>talking 12:15 17:6 19:20 24:3 46:10 107:25 150:6 177:1 192:21 221:24</p> <p>tall 34:9,25 43:14</p> <p>tanks 82:4</p> <p>TANWEER 2:7</p> <p>Tanzi 2:11 150:2,12 171:14</p> <p>TARAR 2:6</p> <p>Tarbela 17:15,20,25 18:1,15 20:4,10,10 21:7 22:6,9,14,15 22:16,19 23:3,4,8,9 23:11 24:8 36:15 40:20 42:12,14</p> <p>tariff 72:18 73:6</p> <p>TARIQ 2:12</p> <p>task 10:23 116:1 149:16,18 182:17</p> <p>team 40:24 41:1</p> <p>technical 2:13,14 72:1 97:8 124:11,18 135:6,17,24 137:5 161:12 173:7,12,16 175:6 182:8 211:25</p>	<p>technicians 11:23 12:3</p> <p>technique 150:14 213:20</p> <p>techniques 13:3 25:8 216:7</p> <p>technological 93:6 212:12 213:22</p> <p>technologies 72:11</p> <p>technology 65:13 93:6 203:21 212:15 213:19</p> <p>tedious 8:5</p> <p>Teesta 54:23 58:6</p> <p>tell 1:6 113:11</p> <p>telling 126:10</p> <p>tells 96:9</p> <p>temperatures 11:4</p> <p>temporarily 1:22</p> <p>temporary 19:14 188:18 195:14</p> <p>ten 20:7 45:3 205:7</p> <p>tend 57:25 87:20 93:7 110:14 111:25</p> <p>tended 15:24</p> <p>tends 26:14 27:9 53:12 217:3,4</p> <p>tenor 134:5</p> <p>ten-year 92:21</p> <p>term 75:13 129:15 188:9 195:12 198:25</p> <p>terms 10:8 17:11 45:6 61:11 72:7 74:11 75:1,12 76:14 82:8 119:18 127:4 134:1 147:21 166:23 176:9 184:1 185:11 185:18 192:21 195:25 196:7,18 197:15 205:9 224:9 224:11</p> <p>territory 174:4</p> <p>Tesla 66:5</p> <p>test 223:7</p> <p>text 120:4 122:5 125:6 148:12 150:3 195:4 196:5</p> <p>texts 4:13</p> <p>thank 1:8 11:7,9 12:9 23:15 35:11 51:24 54:7 56:21 57:10 59:5,7,9 60:19 62:6 62:8,13,14 105:7,13 106:5 107:21,23 108:17 112:5 113:18,20 115:9,19 115:22 131:21,22 132:10 146:10 150:17 163:20 167:12,17 170:3 171:2,8 179:6 180:13 182:15,22 207:3,7 219:16 220:2,4,21,22 222:25 223:22,24 224:5,15</p> <p>their 4:23 11:14 17:19 19:6 21:10 25:25</p>	<p>48:3 49:12 54:6 56:14 68:20 70:8 87:18,24 98:16 100:10 103:21 110:4 118:25 168:15 172:13 178:25 179:3 207:19 213:18 218:14</p> <p>theme 207:12</p> <p>themselves 145:19 174:9</p> <p>therefrom 204:6</p> <p>thermal 65:22 67:3,25 68:2,7 79:13 81:21 93:16,18,20 94:5,13 103:17 106:25</p> <p>thin 11:4</p> <p>thing 22:22 23:7 24:10 35:25 43:3 44:3 45:16 58:17 67:6 76:19 77:24 95:1 97:3 100:23 109:23 109:24 110:25 111:2</p> <p>things 1:6 3:15 13:19 14:25 17:7 24:18 39:23 41:20,25 42:19 48:16 50:24 57:7 67:20 76:20 85:4 109:1 175:8 178:17 181:22</p> <p>think 1:21,25 2:1 5:8 8:21 9:5 17:9 24:9 24:11 25:3 27:2,12 35:25 43:23 44:14 52:7 53:15 55:3 56:21 58:9 62:7,10 62:18 80:6 83:6 89:13 106:3 108:22 111:22 112:12,23 113:7,19 114:5,7,24 114:25 115:20 116:6 122:6 133:18 134:5 138:23 145:11,17 155:18 158:9 161:13 164:3 164:13 165:9,12 166:3,6,15 167:4,7 168:10,12,19,20 169:11 170:1,8 171:6 177:5 180:10 182:16 192:25 209:13 219:19 220:10,14,17 222:11 223:23 224:1,5</p> <p>thinking 21:5 48:12 51:3 143:22</p> <p>third 8:15 53:3 69:13 120:23 146:5 183:16 189:6 195:17 196:6 203:4 222:4 223:3</p> <p>though 15:13 50:3 75:16 88:1 89:23 94:18 118:15 130:2 132:20 133:3,11,23</p>	<p>170:14</p> <p>thought 16:24 25:20 49:22 106:1 113:25 168:5 181:21</p> <p>thoughts 143:23 168:6</p> <p>thousands 15:4,4 84:12</p> <p>threads 3:14 4:15 10:21</p> <p>three 2:12 16:20 22:5 29:12 39:2 52:23 53:1,21 54:3 65:8 104:25 120:7</p> <p>threshold 151:17 163:4,10 164:21</p> <p>through 4:4,23 11:25 12:7,7 13:24 15:16 17:23 18:12,14,14 20:17,20 25:13 28:5 31:18 32:1 42:4,5 42:20 44:5,17 46:14 53:6 55:22 56:10 63:11 64:15 70:8 72:10 73:4 79:21 80:17 87:23 88:8,9 92:19 94:17 97:24 108:8,11,15 110:17 110:17,18,19 113:7 114:16 122:6 127:15 139:5,6,14 139:23 143:16 161:17 168:7 169:1 180:22 183:15 186:7,8,10 190:6 191:2 198:9 199:25 203:11 207:10,12 208:11 210:14 212:18 213:11,24 218:2,6 219:8</p> <p>throughout 29:7 35:16 143:8 146:20 156:3 189:11 208:20</p> <p>Thursday 34:4 35:9</p> <p>tied 72:4 189:17</p> <p>tight 186:3</p> <p>tightly 9:4 10:3 183:7</p> <p>time 3:24 15:24 19:21 19:22 20:9,20,25 21:1,24 24:16 27:23 32:19 37:15 40:18 40:18,22 42:11 43:17 58:25 59:18 62:10 67:9 75:17 77:4,14,17 79:16 81:13,14 83:5 84:8 86:3,5,10 88:24 90:23 92:17 93:3 107:3 108:25 109:18 110:4 111:5 111:10,14,15 113:25 114:2,4 115:1 116:10 117:1 117:21 125:6 133:22 137:8 138:19 157:18 159:13 164:5,9 170:8,9 171:1</p>	<p>178:14 179:19 181:3,7,12 182:2 186:4,19 187:17 199:6 212:15</p> <p>timeliness 186:5</p> <p>timely 210:16</p> <p>times 16:6 86:4 110:15 111:9 203:14</p> <p>time-consuming 44:11</p> <p>time-of-use 110:12</p> <p>timing 87:18 224:11</p> <p>Tinguirica 25:21</p> <p>today 1:17 2:7,13 4:8 12:14 13:1,4 51:15 62:23 63:2 66:18 73:7 82:18 91:20 96:25 112:7,8 116:1 120:6 127:10</p> <p>together 3:14 4:15 10:22 20:8 185:10 192:3 193:3 196:13 222:18</p> <p>told 76:18</p> <p>tomorrow 2:10 3:15 4:10,12,16 10:21 11:2 75:15 114:22 221:25 224:4,12</p> <p>tonnes 18:2,6,19 37:4 39:4</p> <p>tool 167:5</p> <p>top 22:14 28:13,25 29:16 66:1 79:4 86:11 170:24</p> <p>topic 62:23 135:23</p> <p>topics 63:12</p> <p>topography 25:25</p> <p>total 38:2 46:13 64:11 64:13 67:1 68:12,13 70:17 74:23,24 76:11 190:19</p> <p>touches 180:9</p> <p>touching 13:19</p> <p>towards 52:6 57:19 106:9</p> <p>tracked 45:24</p> <p>tracks 94:17</p> <p>traditional 77:19 91:7</p> <p>Trail 146:25 147:11 147:12</p> <p>training 37:18</p> <p>transboundary 215:18</p> <p>transcript 1:23 223:1</p> <p>transfer 95:19 99:13 99:17,23 101:22 102:4</p> <p>transformation 64:11 91:5,12</p> <p>transformer 80:15</p> <p>transition 64:14 71:3 73:15 101:25</p> <p>transmission 70:8 80:8 90:20,22 94:9</p> <p>transport 19:24 35:17 36:6</p> <p>transported 47:24</p> <p>transpose 192:6</p> <p>traps 16:13</p>	<p>travaux 9:16,19 186:8 188:5 190:5 194:5</p> <p>travel 52:10</p> <p>treat 218:19</p> <p>treated 145:3</p> <p>treaties 8:2 135:3 167:23 222:10</p> <p>Treaty's 135:19 136:7 155:15 176:11 203:16 216:12 221:15</p> <p>trend 57:19 63:6</p> <p>trends 92:17 103:4</p> <p>Trevor 1:23</p> <p>tribes 45:8</p> <p>tribunal 147:4</p> <p>tribunals 150:19</p> <p>tributaries 61:18 70:10 202:10</p> <p>tributary 61:19 219:21</p> <p>tried 191:4 214:16</p> <p>tries 217:13</p> <p>true 87:17 147:6,9 181:9 192:19</p> <p>trust 211:19</p> <p>try 18:13 58:13 89:3</p> <p>trying 24:6 44:22 72:3 106:22 107:3,11 111:1 113:2 186:22 220:1</p> <p>tunnel 25:10 26:10,11 27:1,3,9,13 34:7,10 45:19 46:1 58:22,23</p> <p>tunnels 26:16,17 27:5</p> <p>turbidity 25:13</p> <p>turbine 13:21,25 35:24 47:18 80:6,14 80:17,25 82:3,9,13 82:25 83:15 84:16 84:19 85:3 87:19 93:23 95:8,9 107:6 108:1,5,12 124:21 213:9</p> <p>turbines 20:20 22:9 23:9 29:6 37:20 38:3 39:21 40:13,19 46:14 93:19 199:9 212:8</p> <p>turn 22:11 23:9 30:1 40:16 65:6 98:22 110:24 138:4 151:15 188:4 195:2 197:2 199:12 205:12 217:3 224:1</p> <p>turning 24:18,19 74:10 125:10 156:12 172:6</p> <p>turns 24:11 108:10</p> <p>Twenty 2:9,10</p> <p>twice 37:7 38:12</p> <p>two 15:9 18:4,14 20:13 21:12 24:18 25:18 27:22 29:11 30:24 35:3 39:10,23 42:19 45:17 52:25 53:23 54:2 67:20 74:13 79:10 89:2,10</p>
--	---	--	---	--	--

<p>107:24 117:2 118:23 121:23 122:12 138:12,24 145:13 151:17 157:8 167:18 168:19 170:25 171:9 191:15,22 196:12,13 197:13 200:1 203:2 213:23 223:1 two-year 31:14 type 33:20 47:18 55:5 56:5 190:13 types 25:1 32:21 37:11 50:2 57:7 58:23 61:23 138:9,10,12 178:19 typhoons 27:21 typical 77:8 78:6 83:15 85:21 87:13 93:1 95:8 96:20,25 typically 28:7 36:14 40:23 41:8 44:4 47:2 58:18 59:1 67:25 72:20 75:25 83:17 87:22 88:11 101:15 the 130:24</p> <hr/> <p style="text-align: center;">U</p> <p>ultimate 110:23 ultimately 72:17 74:8 88:16 110:18 180:23 ultra 174:11 unambiguous 129:22 unanimously 136:3,17 uncertain 49:17 uncertainty 106:13 unchallenged 147:10 147:16 unclear 113:15 uncontrollable 162:24 199:17 under 6:9 37:23 40:23 54:12 66:3 75:10 86:1,5 114:2 116:2 123:8,18 124:8,17 125:3,19 126:16,21 127:1,9 128:17 134:3 135:7,9,16,18 140:14 142:3,5,17 142:20,25 145:12 146:6 149:16,19 150:24 151:18,20 155:20,24 156:9 157:4,7 158:17 159:17 160:4 161:2 161:11 162:2 163:2 166:18 167:6 168:13 172:10,14 173:13,15 174:11 174:18 176:10 178:1 180:3 185:25 187:5,8 188:1 191:4 197:4,23 200:22,25 204:1,20 205:20 208:12 209:17,23</p>	<p>216:3 220:19 underground 56:19 underlying 66:7 73:18 73:25 145:19,24 146:13 148:21,25 155:10 202:18 215:5 undermined 142:23 146:9 underneath 89:1 underpin 144:12 183:18 184:1 underpinned 219:10 underpinning 161:14 189:10 underpinnings 3:10 8:7 underpins 182:25 underscore 9:17 understand 4:20,21 16:17 17:8 20:18 23:18 36:1,18 50:10 55:11 56:25 68:16 82:5 87:10 145:1 165:24 192:15 206:22 understanding 15:16 23:20 51:13 107:25 109:15 133:17,23 133:25 199:22 understood 186:4 undertake 207:23 undertaken 215:15 underwater 21:19 unfavourable 126:15 unfettered 9:21 unfold 1:6 unforeseen 129:4 152:12 198:21 203:22 unfortunately 49:18 56:14 111:19 135:12 ungated 56:6 uniform 110:17 unilateral 219:7 unique 4:19 25:24 unit 108:15 United 14:15 44:1 60:7 78:5 93:20 98:15 109:20 110:21 167:11 units 83:1 unless 114:5 179:5 192:5 224:2 unlike 136:21 173:14 unlimited 61:5 unmoved 155:7 unpack 10:19 unpackage 138:17 unrealistic 160:15 unreliable 96:7 unrestricted 8:25 9:1 9:10,23 10:10 183:2 184:2,10,19 185:9 186:20 187:11,24 189:8,12 192:1 193:13 195:9</p>	<p>211:17 unshakable 147:15 unsurprisingly 163:1 until 1:22 115:12 116:7 224:17 unusual 14:9 44:24 184:15 unusually 4:20,21 upheavals 94:2 uplifting 2:1 upper 86:7 87:20 199:13 uprise 93:25 upstream 17:17,18 18:14 20:13 23:21 23:25 26:23 28:17 34:23 35:6 36:4 42:13,15,18 45:20 45:22 55:13 59:22 61:9,20 62:4 80:11 162:5 usable 185:3 usage 65:22 102:11 199:2 use 8:25 9:1,10,21,23 10:10 20:3,14 22:15 25:16,25 32:6 36:22 38:20 45:17 63:21 65:7 68:4 69:4 75:1 77:4 96:15 97:18 100:8 101:8,24 105:2 109:1 111:1,5 112:1 154:16 161:5 161:7 183:2,23 184:2,10,19 185:4,9 185:12,25 186:23 187:11,24 189:8,9 189:12,14 190:13 190:14 192:1 193:13 195:9,20,22 196:14,19 197:10 202:12,25 203:5,9 203:18,23 204:3,4,8 204:10,17 205:1,5,7 207:17 211:17 212:10,11 214:16 217:21 221:18 222:2,7 used 27:14 33:21 42:19,19 63:4 64:11 75:5,13 85:18 91:20 97:10,23 100:9 101:6 102:1,6 104:16,18 108:25 183:9 199:1,5 201:3 useful 78:6 104:8 191:23 user 70:5 uses 26:13 65:15,17 77:20 96:18 183:16 186:19 190:20,22 203:2 using 23:22 42:21 47:19 67:19 88:1 93:21 95:13 109:20 201:4 usually 199:18 US-Canada 184:25</p>	<p>utile 194:17 utilised 217:15 utilisation 70:25 utilities 104:2 110:13 utility 70:5 72:19 73:16 75:18 79:18 97:17 99:21 110:8 110:23 utility-scale 90:8 96:18 utilization 151:3</p> <hr/> <p style="text-align: center;">V</p> <p>v 145:4 valid 128:7 valley 16:10 57:12 valuable 79:6,23 101:1 value 23:20,25 79:24 92:10 93:1,14 94:5 101:2 102:10,10 123:4 124:2,6 125:12 126:9 130:15 132:17,22 132:23 134:12 136:20 177:23 values 92:15 value-neutral 200:5 variabilities 109:16 variability 60:10 86:10 91:4 95:1 97:25 98:10 106:14 108:19,20,20 variable 84:22 98:22 103:6 104:15 107:4 107:4 variation 86:15 87:16 88:9 108:3 variations 85:2 199:10 varies 81:4 94:19 variety 24:7 97:8 175:5 210:8 various 10:22 78:11 91:2 116:25 222:22 vary 83:24 84:4,16 87:24 93:8 varying 78:14 vast 16:15 Vaughn 1:23 vegetation 14:5,13 vegetative 14:7 16:7 vehicle 45:24 velocities 52:11 velocity 18:4,5 28:22 Venezuela 216:10 verify 211:20 versed 119:22 version 188:12,23 versus 58:2,22 vertical 38:6 83:17 Verulam 2:10,11 veteran 4:24 viable 13:12 50:15 Vienna 135:16 193:24 194:6 view 20:5 33:25 54:16 81:18 126:14,15 129:22 136:7 200:3</p>	<p>200:3 views 59:6 128:12 VII 208:24 VIII 209:18 VII(2) 209:1 VILMANTE 2:21 violation 218:16 vires 174:11 virtue 141:10 visible 45:21 visit 3:20 5:10 82:4,22 106:1 visiting 105:16 visits 19:1 223:16 visualise 16:2 vis-à-vis 125:10 vitality 151:2 VI(2) 208:22 voltage 66:6 78:13 volume 30:5 77:2,2 85:7 101:18,20 114:16 185:19 188:11,17,23 198:1 198:2 vulnerable 186:18</p> <hr/> <p style="text-align: center;">W</p> <p>WAHEED 2:6 Waldock 8:22 193:19 Waldock's 196:3 walked 168:7 walking 18:1 wall 201:3,8 want 13:10 15:3 16:17 20:3 29:25 30:14 32:17,25 34:3 37:1 55:24 59:1,4 61:14 83:17 88:19 99:6 102:13 103:1 109:14 110:21 113:20 114:22,24 133:24 169:12 170:15,21 186:9 193:18 194:3 198:11 212:24 213:24 219:17 223:18 wanted 67:14 139:16 wants 18:17 warning 1:10 warranted 131:9 Warsak 30:23 41:9 53:14 washing 203:3 wasn't 97:13 105:22 113:11 142:14 171:22 179:20 181:6 182:2 191:16 215:12 219:7 220:8 water 2:4 14:12 17:10 19:8,10 22:8 25:16 28:8,13 29:4,5 30:5 30:21 31:3,18 36:3 36:3,7,9,11,19 38:6 39:9 40:4,5,11,14 41:7 48:2,24 52:6 52:10,24 53:1,23 60:14 61:22 77:2,12</p>	<p>80:5,10,12,17 81:24 82:17 84:17 99:19 108:4 112:10 152:11 154:20 184:13,17 185:1 189:3 190:3 195:14 196:14 198:1,17,24 199:4 200:17,17 201:1,5,5 203:10,17 203:20,21,24 204:2 204:5,12 205:1,5,10 205:16 watercourse 204:12 watercourses 161:2 waterpower 64:12 waters 1:2 2:4 7:3,12 9:1,21,24 50:7 66:10 67:13 69:15 75:3 102:12 118:25 127:4,17 149:16 150:25 161:6 168:22 183:3,4,5,9 183:23 184:7,10,19 185:12,19,22,24 186:2 188:9,20 189:8,9,13,15 195:11,12,20,22 196:19 197:10 202:14 203:12 205:25 208:9 209:3 209:8 217:15,22 218:6 watershed 14:2,4,12 14:19,21 15:3,6 26:23 60:2 61:21 71:6 96:8 watersheds 48:25 49:4,4,5,24 71:11 way 9:5 12:21 20:2,3 22:13 33:16,17,18 37:25 49:8,23,25 50:23,24,24 51:9,18 52:8 55:18 61:4 69:3 73:11 76:15 91:15 92:10 101:23 101:24 106:23,25 107:15 110:22 116:13 133:21 135:8 146:2,16 150:5 170:6 174:7 195:4 205:19 215:25 222:23 ways 12:17 35:3 50:10 50:13,14 100:18 110:2 135:14 223:18 weakness 132:19 weaponisation 52:2 Webb 2:10 3:25 2:23 8:11,21 9:6 10:19 114:13 115:4 170:21 182:17,22 191:20,24 192:19 192:24 206:6,7,8,11 206:13,15,17,24 207:4,8 219:16,24 220:2,14,20 221:17 222:25 223:21,24</p>
--	---	---	---	--	--

<p>Webb's 114:20 Wednesday 1:6 1:1 week 24:25 63:11 103:20 112:20 133:22 134:8 150:16 171:15 weekly 199:10 weeks 52:24 53:1 weigh 8:3 weighing 7:19,22 weight 5:18,19,25 6:19,23 weighted 92:15 welcome 113:9,10 143:23 150:10 welcomes 121:5 well 7:22 11:11,14 17:8 33:16 48:21 53:10 57:18 60:10 66:14,15 67:5 70:11 71:12 84:25 90:3,7 90:9 98:23 100:3 101:9 111:16 113:9 113:22,23 115:6 119:22 133:6,18 154:4,7 164:13 166:3 168:12 170:23 174:20 179:24 181:21 182:3 191:17 192:12,16 201:21 206:19 220:20 went 56:11 109:8 162:4 177:19 were 4:1 5:3 6:3 11:11 13:1,7 37:19 42:12 45:9 56:23 59:18 65:5 82:5,6 83:1,1,4 87:6 88:25 91:12 105:19,20 109:7 112:7 113:1 114:9 123:17,20 130:11 136:6,9 146:3 147:11 156:25 157:3,4 158:18 168:3 170:7,11 177:15 182:7 201:13 206:1 211:4 216:3 219:4 221:1 222:19 weren't 37:19 51:3,3 west 37:13 western 3:23 2:24 8:14 9:2,21 69:23 120:15 123:10,21 124:7 126:4 128:2 128:25 129:6,25 130:7 131:19 138:3 151:14,21 152:15 153:2,8 154:22 155:12 156:24 157:2 158:3 161:6 166:19 178:2,5,11 182:21,24 183:3,9 183:24 184:13 185:13,21 186:2,6 186:19 190:4,13,19 195:11,12,20</p>	<p>196:15 197:12 200:17 203:24 204:3,25 205:9 210:17 217:10 218:1 221:22 Westinghouse 66:4 wet 28:6,11 29:4,8 30:4 38:18 84:5 88:5 99:17,19,25 102:20 we'll 1:24 25:2 34:3 35:4 36:14 37:3 42:1 64:5 106:4 109:13 126:5 129:15 136:20 151:15 170:5 171:1 171:1,16 199:6 220:23 221:24 224:14 we're 7:4 8:4 15:14 18:11 19:11 20:19 22:3,13 49:11 69:15 71:10 72:3 74:19 76:14 86:20,21 92:22 95:23 100:8 101:7,15,16,23 102:4 106:22 107:8 107:11 109:20 111:9 114:2 115:20 143:21 164:4 170:1 170:8 192:21 193:10 we've 11:22 16:12,12 20:16,23 27:7 35:14 52:11,18 53:13 88:22 94:1 100:21 105:15 114:20 136:14 150:6 167:21 172:7 175:7 175:17 177:20 185:24 198:18 204:16 218:7 whatnot 86:19 98:1 192:22 whichever 20:3 81:16 while 2:2 11:19 65:9 72:22 93:12 117:1 119:4 120:18 129:11 130:17 131:24 135:4 168:5 177:13 186:21 191:3 197:25 218:16 white 32:22 whole 16:20 18:11 40:18 58:13 78:1 81:13 89:13 97:5 99:23 104:20 110:8 110:15 144:1 154:3 156:5 wicket 82:10,12 108:9 108:10 wide 31:18 34:11 43:14 wider 34:15,15 widith 31:7 32:2 34:17 34:19,20 43:5,12,13 Wildlife 44:8</p>	<p>WILLIAMS 2:20 willing 133:4 wind 5:8 63:7 68:19 79:8,9,18 89:20,24 90:6,11,13,24 92:6 92:9,23 93:3 97:14 98:11 100:23 102:16 103:24,25 windows 1:21 winds 11:5 windy 97:13 winter 37:23 38:21 201:4 wiped 56:15 wishes 23:24 withdrawal 188:10 withdrawn 204:6 witness 4:4 wonder 114:18 220:12 wondered 19:25 wonderful 17:2 wondering 16:23 21:2 21:5 60:22 114:3 132:5 143:12 168:2 168:10 179:12 221:4 word 17:11 20:3 69:19 101:5 149:14,15 wording 124:25 133:3 144:19,22 145:7 169:8 171:12 173:18 185:7 197:21 words 12:1,8 13:18 30:12 117:18 122:6 123:20 124:5 143:13 150:20 153:21 164:2 184:15 191:14 194:17 201:9 work 14:22,22,23 21:25 26:9,13 50:16 51:1,1 55:18 56:13 58:11 61:13 69:25 71:16 103:15 106:24 146:22 187:3 192:9,11 194:20 200:25 201:19,21 205:21 205:23,24 206:10 207:5 209:3,6,7 210:25 211:4,4 219:25 220:15,19 worked 13:14 14:18 23:2 25:19 27:7 35:15 43:7 45:3 48:13 50:17,21 103:22 working 2:3 5:14 17:7 18:12 20:6 51:5,14 61:24 83:4 works 14:21 20:18,18 38:14 90:1 107:19 187:5 192:16 193:4 197:22,25 201:16 205:16 207:9,10,20 210:10 world 38:10 39:3</p>	<p>45:13 60:6 64:9 69:5,14 70:6 71:9 89:19 92:15 94:4 98:3 103:8 187:9 191:5 219:6 worrying 52:21 worst 44:3 worth 24:22 185:6 221:11 wouldn't 21:21,21 58:14 185:20 WOUTER 1:12 writing 141:12 165:16 167:14 209:25 214:13 written 106:3 194:21 wrong 126:19 136:4 222:20 wrote 190:17</p> <hr/> <p style="text-align: center;">X</p> <p>XI 135:20 XII 135:20</p> <hr/> <p style="text-align: center;">Y</p> <p>year 18:19,24 24:24 27:23 29:7,12,25 37:4 45:17 46:5,9 67:12 76:17 87:6,6 87:14 88:2,5 99:24 111:24 141:9 years 12:20 13:15 17:20 20:7 21:9,9 30:24 37:11 39:13 45:3 48:17 56:16 58:20,20 59:17,20 60:8 65:5 74:7 87:10 90:12 94:2 103:6,22 165:18 178:8 203:15 219:5 year's 24:22 141:23 year-round 39:15 104:3 yellow 30:20 92:18,19 yesterday 1:11,16 2:5 4:8 9:15 10:18 11:18 22:24 29:23 34:13 38:8 49:11 54:10 155:18 184:14 188:2 192:25 193:21 198:14 217:15,24 yield 13:16,22 72:24</p> <hr/> <p style="text-align: center;">Z</p> <p>Zealand 216:9 zero 53:24 99:18 109:8 ZOHAIR 2:6 zone 26:12</p> <hr/> <p style="text-align: center;">\$</p> <p>\$1.5 58:4 \$500 23:12,13</p> <hr/> <p style="text-align: center;">0</p> <p>0.2 69:17</p>	<p style="text-align: center;">1</p> <p>1 3:1,2 9:9 22:19 23:5 24:18 32:19 39:10 115:25 139:20 143:16 173:8,8,8,24 179:15 182:22 185:7 197:15,17 1,000 58:2,3 1,200 54:25 58:7 1,400 22:7 1.02 115:11 1.5 18:22 10 1:6 1:1 28:22 69:20 138:7 186:13 187:7 190:10 210:20 10,000 97:21 10-15 67:12 114:19 10.54 51:22 100 12:20 14:9 16:6 27:12 32:18 39:13 86:9,21,21 100% 83:18 171:21 202:13 100,000 18:20 41:8,20 70:16 100-year-old 22:25 105 3:12 108th 127:20 11 21:9 71:18 139:25 172:15,16 193:6 207:8 210:20 11% 68:15 11.11 62:15 11.40 62:11 11.41 62:17 110th 128:20 129:18 115 3:13,16 116 149:5 117 149:21 162:1 163:14 165:17 118 163:14 119 162:1 165:17 12 3:3,5 21:9,9 71:21 140:8 143:11 195:4 197:4 210:21 12% 68:13 12.47 105:11 120 56:16 120% 86:11 123 141:22 13 74:10 143:7 146:19 174:5 180:11 197:17 204:2 13.14 171:15 130,000 41:11 131 3:17 14 78:2 147:17 178:5 198:3,20 14,000 22:10,11 143 3:18 144 36:24 149 3:19 15 3:6 59:17 80:2 111:15 148:2 198:16 201:25 202:1,5,11 15-minute 170:24 150 18:2</p>	<p>158 3:20 16 80:4 138:25 140:9 141:3 149:3 199:20 163 3:21 17 81:20 151:22 200:2 179 3:22 18 83:14 123:19 152:9 154:13 200:13 18th 64:16 18.35 201:9 1800 64:9 182 3:23,25 189 141:22 19 85:21 152:24 178:6 198:19 200:20 206:9 19th 65:3 191 4:1 1939 147:19 1941 147:2 1950s 64:20 1957 186:13 187:7 1959 187:12,15 188:7 190:10,17 1960 1:2 191:2,7 203:18 212:13 215:12 1961 184:25 1962 45:12,15 1971 200:25 1975 20:11 1998 20:24</p> <hr/> <p style="text-align: center;">2</p> <p>2 9:9 23:5 24:20 63:2 115:1 116:11 139:21 152:17 183:12 196:9 197:8 2F.1 122:23 2F.2 122:23 2% 21:11,17 2(a) 198:17 2(b) 199:3 2(g) 196:20 198:3 2.00 114:4 2.15 114:4 115:6,10,12 2.21 115:13 20 37:6 58:2 86:25 111:15 201:24 20th 64:19 65:3,6 70:3 20-year 28:22 200 18:19 34:8 37:13 148:4 2000 190:22 2006 201:7 2007 6:1 119:5 215:20 2008 111:18 2010 215:14 2012 148:20,22 149:1 2013 21:8 55:4 119:1,3 123:19 127:5,20 154:13 2014 87:7 128:20 2015 87:7 111:18 127:5 130:8,11,13 2015/16 111:18 2016 7:2 130:12,21 131:13</p>
---	---	--	--	--	---

<p>2023 67:16 116:4 2023-01 1:3 2024 1:6 1:1 20:11 96:21 206 4:2 21 88:18 111:16 153:15 190:17 202:19 219 4:3 22 89:15 153:24 203:8 22,500 39:3 220-million-cubic-m... 201:2 23 90:3 117:6 140:9,10 140:24 141:8,10,11 142:5 143:18 145:7 145:12 154:12 171:12 173:8,13 204:7 236 201:12 239 169:15 24 77:1 91:24 117:11 127:21 155:7 205:6 24/7 37:15 25 93:15 131:13 153:15 156:19 205:12 26 94:15 158:22 205:20 27 96:19 153:24 159:5 206:1 220:6 28 98:18 137:11 160:11 207:8 29 101:5 160:22,25 167:21 168:11 169:6 207:12 223:6</p> <hr/> <p style="text-align: center;">3</p> <p>3 1:6 2:10,11 3:1 1:13 31:1 63:12 119:16 154:23 183:22 184:9 197:15 3% 21:16 3,000 58:13 3,500 25:24 3-kilometre 27:3 3.3 92:24 93:16 3.47 171:3 3.5 27:2 30 12:14 23:10,10 40:20 56:3 60:8 90:15 102:23 161:8 207:25 30% 68:12,23 30,000 90:17 30-year 111:15 30/20 58:14 31 12:17 103:4 161:20 163:22 193:23 194:1,13 209:1 316 174:14 32 3:7 13:22 118:7 139:17 172:6 193:23 194:1 209:16 33 14:2 172:16 209:23 34 25:7 118:8 155:9 173:4 210:19</p>	<p>35 25:15 53:15 173:20 183:21 211:21 35(a) 2:20 6:19 35(b) 3:1 211:22 221:2 35.48-metre-high 201:8 36 25:21 174:22 214:4 37 26:10 175:19 218:17 38 26:19 149:7 168:1 175:24 39 27:15 176:21</p> <hr/> <p style="text-align: center;">4</p> <p>4 31:1 64:5 122:4 184:11 185:6 209:19 4,000 25:23 4.02 171:5 4.110 177:8 4.15 179:7 4.22 182:20 4.44 176:25 4.9 92:22 93:16 4.97 217:12 40 17:20 18:5,6 29:20 37:6 177:8 40% 17:16 20:12 46:13 40-50 59:20 400 39:4 41 177:20 42 35:25 43 36:22 37:4 43% 38:3 44 37:3 443 211:11 444 211:11 45 23:10 39:1 450 215:15 452 160:17 457 151:5 46 39:18 466 153:4 469 175:19 47 41:4 470 161:13 175:25 176:9 177:21 48 42:3 43:4 49 43:21</p> <hr/> <p style="text-align: center;">5</p> <p>5 64:7 96:21 122:19 186:12 5.1 135:22 5.18 219:14 5.26 224:16 5.30 1:11 114:22,24 170:22 5.8 93:24 94:6 50 12:20 22:10 41:1 44:25 504 190:1 506 207:13 51 3:8 46:21 52 47:15 522 175:2 200:8 216:21</p>	<p>523 159:4 528,000 46:4 53 48:8 54 50:9 57 69:10 57% 68:1,4 59 148:7</p> <hr/> <p style="text-align: center;">6</p> <p>6 64:22 93:1,1,16 116:3,4,16,17 117:6 119:17,24 127:19 137:10 183:21 187:13 211:22 60 58:20 60% 83:18 600 184:17 61 148:12 62 3:9,11 660 39:5</p> <hr/> <p style="text-align: center;">7</p> <p>7 66:13 116:6 128:19 172:15 173:20 180:3 188:7 206:2 206:20 219:18 7(b) 219:22 7(c) 206:14 7,000 46:6 70 18:3,6 74 45:4 46:5 75 170:22 75% 68:8 77-metre-high 201:3</p> <hr/> <p style="text-align: center;">8</p> <p>8 2:11 4:11 7:15 10:24 66:24 114:21 116:6 116:8 129:17 138:24 189:6 196:23 199:22 201:24 202:21 212:1 218:3 8(a) 124:19 8(c) 124:20 199:15 8(d) 212:20 8(e) 124:20 8(f) 124:21 8(g) 200:15 8.62 140:5 8.69 140:5 8.70 143:3 8.73 169:14 171:19 80% 83:19 86:11</p> <hr/> <p style="text-align: center;">9</p> <p>9 46:8 67:14 112:16 130:10 165:5 189:21 209:23 9.30 224:14,17 9.33 1:2 9.34 1:12 9.50 12:11 900 46:7 69:17 95 32:18 96 32:18 97 32:18</p>	<p>98 32:18 99 32:18</p>		
---	--	---	---	--	--