

PCA Case No. 2023-01

IN THE MATTER OF  
THE INDUS WATERS WESTERN RIVERS 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

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

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**COURT OF ARBITRATION:**

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

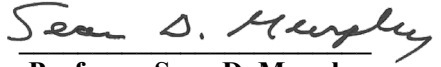
**SECRETARIAT:**

The Permanent Court of Arbitration

ON BEHALF OF THE COURT OF  
ARBITRATION:

CERTIFIED PURSUANT  
TO  
PARAGRAPH 19 OF ANNEXURE G

2 FEBRUARY 2026

  
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 1 Monday, 2 February 2026  
Hearing on the Second Phase on the Merits

Before:

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

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BETWEEN:

THE ISLAMIC REPUBLIC OF PAKISTAN

-and-

THE REPUBLIC OF INDIA

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Transcript produced by Trevor McGowan,  
Georgina Vaughn and Lisa Gulland.

Trevor McGowan CR

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<p>08:55 1 Monday, 2 February 2026 2 (9.38 am) 3 Opening Remarks 4 THE CHAIRMAN: Welcome, everyone. It's very good to see you 5 and I hope everyone had safe travels to The Hague for 6 this hearing. 7 This hearing is PCA Case No. 2023-01: that's the 8 Indus Waters Western Rivers Arbitration between the 9 Islamic Republic of Pakistan and the Republic of India. 10 I'm Professor Sean Murphy, the Chair of this Court 11 of Arbitration, and I'm joined by the other members: 12 Mr Don Blackmore, Professor Wouter Buytaert, 13 Professor Jeffrey Minear and Judge Awn Al-Khasawneh. 14 Members of our Secretariat are also present: our 15 registrar, Mr Garth Schofield; our treasurer, Mr Bryce 16 Williams; and Mr Sebastian King. Our court reporter is 17 Mr Trevor McGowan. And we also have an assistant to 18 Judge Al-Khasawneh for this hearing, Ms Fedelma 19 Smith-Ruiz. 20 I take note of the presence of the delegation of 21 Pakistan and of its Agent, the Attorney General of 22 Pakistan, Mr Mansoor Usman Awan. It's very good to see 23 you here, Mr Awan, and to see the other representatives 24 from the Government of Pakistan. 25 I take further note of the presence of Sir Daniel</p> <p style="text-align: center;">Page 1</p>	<p>09:41 1 interpretation and application of the Treaty, and of the 2 facts relevant for disposition of the questions before 3 us. Our door remains wide open for India in that 4 regard. 5 Given India's absence, the Court has strived to 6 develop fully all sides of the issues that are before 7 it, including by carefully reviewing positions taken by 8 India in communications between the Governments, before 9 the Indus Rivers Commission and in past dispute 10 settlement proceedings under the Treaty. The Court will 11 continue to do so in order to ensure fair treatment of 12 the Parties and the sound administration of justice. 13 As a prelude to this particular hearing, I note 14 the following recent events. 15 On 8 August 2025, the Court issued an Award on 16 Issues of General Interpretation in which the Court 17 addressed the matters before it in the First Phase on 18 the Merits. 19 On 19 September 2025, Pakistan transmitted a letter 20 to the Court in which it requested the Court's 21 clarification of a number of points arising out of that 22 Award. 23 On 8 November 2025, the Court issued a Decision on 24 Pakistan's Request in which the Court provided 25 clarifications with respect to some aspects of the</p> <p style="text-align: center;">Page 3</p>
<p>09:39 1 Bethlehem. Welcome to you, Sir Daniel, and to your 2 entire team of legal counsel and experts. 3 Though I believe we are rather familiar with each 4 other, may I invite either Mr Awan or Sir Daniel or both 5 of you to introduce the members of your delegation. 6 MR AWAN: Thank you, Professor Murphy. Thank you very much. 7 I have Sir Daniel Bethlehem, who you are already 8 familiar with, to my right. And to my left, I have 9 Mr Syed Haidar Shah Ambassador, Embassy of Pakistan to 10 the Kingdom of the Netherlands; I have Syed Mehar Ali 11 Shah, who is Pakistan's Commissioner for Indus Waters; 12 Mr Jamal Nasir, Deputy Head of Mission at the Embassy of 13 Pakistan to the Kingdom of the Netherlands; and I have 14 then Professor Philippa Webb, Dr Cameron Miles, 15 Ms Charlotte Westbrook, Mr Abdullah Tariq, 16 Mr Peter J Rae and Dr Gregory L Morris as part of 17 Pakistan's team and delegation. 18 Thank you. 19 THE CHAIRMAN: Thank you very much, Mr Attorney General. 20 I take note of the absence of a delegation from 21 India. As I have done in the past, I express regret on 22 behalf of the Court that India has chosen not to 23 participate in these proceedings. The work of the Court 24 would greatly benefit from India's presence, which would 25 allow us to hear directly from India its views as to the</p> <p style="text-align: center;">Page 2</p>	<p>09:42 1 request for clarification but declined to provide 2 clarifications with respect to other aspects of the 3 request. Among those other aspects was Pakistan's 4 request for clarification as to how the Treaty regulates 5 the basis upon which India must determine the installed 6 capacity and anticipated load of a proposed Annexure D, 7 Part 3 hydroelectric plant; and, once determined, how 8 those elements are to be taken into account for purposes 9 of the calculation of maximum pondage. For convenience, 10 I will refer to these as the capacity/load/pondage 11 calculation issues. 12 Also on 8 November 2025, the Court issued Procedural 13 Order No. 16, indicating, among other things, that 14 either party may request a further phase of the 15 proceedings specific to the capacity/load/pondage 16 calculation issues. Thereafter, on 13 November 2025, 17 Pakistan requested a further phase of the proceedings 18 specific to those issues. 19 On 21 November 2025, the Court issued Procedural 20 Order No. 17, in which the Court determined to conduct 21 a further phase of the proceedings specific to resolving 22 the capacity/load/pondage calculation issues, which the 23 Court refers to as the "Second Phase on the Merits". In 24 that order, the Court indicated the dates for filing 25 written pleadings and for the holding of an oral</p> <p style="text-align: center;">Page 4</p>

<p>09:44 1 hearing.                  2 On 9 December [2025], the Court wrote to                  3 the Parties, through its registrar, transmitting                  4 an adjustable Excel table that incorporated constraints                  5 as set out in the Treaty which the Court indicated might                  6 serve as a tool for considering the issues in this                  7 Second Phase. I will refer to this as the "adjustable                  8 operating pool calculations table". For illustrative                  9 purposes, the table is populated with the operating pool                  10 calculations used by India for the Kiru Hydroelectric                  11 Plant. The Court invited the Parties, in their                  12 submissions for the Second Phase, to address a series of                  13 propositions that seemed to flow from experimenting with                  14 adjustments to the table.                  15 By letter of 9 January 2026, Pakistan sought further                  16 guidance as to the adjustable operating pool                  17 calculations table, to which the Court responded on                  18 17 January.                  19 On 19 January 2026, Pakistan submitted its Memorial                  20 for the Second Phase on the Merits. That Second Phase                  21 Memorial included Appendices A to E, as well as a number                  22 of new and resubmitted exhibits and updated indices.                  23 Although requested to do so by the Court, India did                  24 not indicate an intention to submit a counter-memorial                  25 or to otherwise participate in the Second Phase on the</p> <p style="text-align: center;">Page 5</p>	<p>09:47 1 the course of today.                  2 Before turning to Pakistan to commence its                  3 first-round submissions, I note that there is                  4 an outstanding issue concerning document production for                  5 this Second Phase on the Merits.                  6 On 9 January 2026, Pakistan provided a submission                  7 addressing the status of the Neutral Expert proceedings                  8 in which Pakistan also applied to the Court for                  9 directions regarding, among other things, the disclosure                  10 of information in its possession from the Neutral Expert                  11 proceedings that Pakistan considers to be directly                  12 relevant and material to the issues before the Court in                  13 the Second Phase on the Merits. I will refer to this                  14 information as the "Neutral Expert pondage documents".                  15 There appear to be two types of information at                  16 stake: first, logbook data for the operating pools of                  17 the Baglihar HEP and the Kishenganga HEP, which I will                  18 refer to as the "pondage logbooks"; and second,                  19 Pakistan's analysis of this data, which I will refer to                  20 as the "pondage logbook analysis".                  21 On 17 January 2026, the Court essentially requested                  22 greater specificity with respect to the nature, scope                  23 and relevance of the Neutral Expert pondage documents,                  24 and provided guidance as to how such a document                  25 production request might be addressed.</p> <p style="text-align: center;">Page 7</p>
<p>09:46 1 Merits by the deadline fixed by the Court, nor has it                  2 done so to date.                  3 This hearing therefore is to address the                  4 capacity/load/pondage calculation issues that are                  5 subject of this Second Phase on the Merits.                  6 On 24 January 2026, the Court issued Procedural                  7 Order No. 18, on the organisation of this hearing, to                  8 which was attached a hearing schedule. Pursuant to that                  9 schedule, we will have first-round submissions by                  10 Pakistan today, followed by second-round submissions                  11 tomorrow afternoon.                  12 After tomorrow's second-round submissions, the Court                  13 will also engage with Pakistan as to future phases of                  14 these proceedings. And in that regard, the Court takes                  15 note of Pakistan's letter of yesterday, 1 February,                  16 addressing such matters.                  17 If past is prologue, the Court will have questions                  18 for Pakistan during the course of today's first-round                  19 submissions, which may be answered immediately or may be                  20 held for response by Pakistan in the second round. Even                  21 if a preliminary answer is provided today, Pakistan                  22 should feel free to embellish on its answers further                  23 tomorrow. At the end of today, the Court will indicate                  24 if it has additional questions to be addressed during                  25 the second round that had not already been posed during</p> <p style="text-align: center;">Page 6</p>	<p>09:49 1 On 23 January 2026, Pakistan further clarified                  2 the nature, scope and relevance of the Neutral Expert                  3 pondage documents to the issues before the Court in                  4 the Second Phase on the Merits.                  5 On 24 January 2026, the Court invited India to                  6 provide comments on Pakistan's letter dated                  7 23 January 2026 by no later than 28 January 2026. India                  8 did not provide any comments by that deadline.                  9 On 29 January 2026, the Court issued Procedural                  10 Order No. 19, which set forth general considerations                  11 with respect to production or disclosure of documents                  12 from the Neutral Expert's proceedings.                  13 With respect to the Neutral Expert pondage                  14 documents, the Court ordered Pakistan by today's date,                  15 2 February, to specify to India the documents comprising                  16 the pondage logbooks that Pakistan seeks to introduce in                  17 these proceedings. Further, the court ordered India by                  18 next Monday, 9 February, either to produce those                  19 logbooks or to inform the Court that it does not agree                  20 with Pakistan as to the scope of such documents. The                  21 Court made no such order with respect to the pondage                  22 logbook analysis, leaving Pakistan to analyse the                  23 pondage logbooks as it sees fit, if and when they are                  24 introduced into these proceedings.                  25 Thus, the Court now awaits India's response by</p> <p style="text-align: center;">Page 8</p>

09:51 1 9 February. The Court has invited Pakistan in the  
 2 course of this hearing to address what further order,  
 3 with specificity, it intends to seek from the Court  
 4 should India fail to respond.  
 5 That concludes my introductory remarks. I turn now  
 6 to the Agent of Pakistan, the Attorney General, to  
 7 commence Pakistan's first-round submissions.  
 8 You have the floor, sir.  
 9 (9.52 am)  
 10 First-round submissions on behalf of  
 11 the Islamic Republic of Pakistan  
 12 MR AWAN: Mr Chairman, members of the Court of Arbitration,  
 13 members of the Secretariat, it is an honour for me to  
 14 appear before you as Pakistan's Agent at the opening of  
 15 this hearing in the Second Phase on the Merits. This  
 16 phase is of great importance, as it should conclude the  
 17 Court's proceedings on general interpretative issues.  
 18 It should also enable the Neutral Expert in the parallel  
 19 proceedings to progress and conclude his enquiry  
 20 concerned with the consistency of the Kishenganga and  
 21 Ratle hydroelectric plants with the design criteria in  
 22 Annex D of the Indus Waters Treaty.  
 23 Pakistan's counsel, who are by now very familiar to  
 24 you, will develop Pakistan's submissions on the issues  
 25 engaged by the present phase. You have received our

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09:55 1 Treaty. More significantly, the very application of the  
 2 Treaty has become a very heavy cudgel that India is  
 3 using against Pakistan, while at the same time pursuing  
 4 policies in breach of the Treaty under cover of  
 5 a contention that the Treaty is in abeyance and thus no  
 6 longer constraining of India's conduct.  
 7 In the shadow of a hot war, and with threats of  
 8 renewed kinetic action all around, those in Pakistan  
 9 concerned with the empire of law have been working to  
 10 stabilise the ship by consciously emphasising and  
 11 reinforcing third-party dispute settlement proceedings  
 12 to resolve differences. It is in this spirit that  
 13 Pakistan has come before you again in these proceedings,  
 14 in visual acknowledgement that the sanctity and reach of  
 15 treaties is important, and that the peaceful settlement  
 16 of disputes through binding third-party adjudication  
 17 must be preserved.  
 18 Pakistan is adopting the same approach in the  
 19 parallel Neutral Expert proceedings, which Pakistan  
 20 insisted should continue to their conclusion  
 21 notwithstanding that India walked away from proceedings  
 22 that it commenced in pursuit of its policy of abeyance.  
 23 If there is to be a pathway back to engagement under  
 24 the Treaty, and through such engagement to wider  
 25 cooperation between the Parties on water and related

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09:53 1 Memorial. They will develop the issues addressed  
 2 therein, and stand ready to assist the Court with any  
 3 questions you may have. Before they do so, there are  
 4 some brief introductory remarks that I should make, both  
 5 in my capacity as Pakistan's Agent in these proceedings  
 6 and as Pakistan's Attorney General.  
 7 We are going through difficult times in our region.  
 8 Sadly, along with other issues, the Indus Waters Treaty  
 9 itself is in the firing line, not just the differences  
 10 between the Parties about the contours of hydroelectric  
 11 projects that are proposed on the Western Rivers.  
 12 As we observed in our Memorial to you, submitted  
 13 about a fortnight ago, the current events recall the  
 14 dispute of 1948 when Indian East Punjab shut down the  
 15 flow of water to canals in Pakistani Punjab. That  
 16 interference with the flow of water lasted over a month,  
 17 but it had lasting ramifications with which we are still  
 18 living today. It was the primary impetus for the  
 19 negotiation and conclusion of the Indus Waters Treaty.  
 20 It also left lasting scars in Pakistan over India's  
 21 ability to weaponise water, about which you have heard  
 22 from us at length in these proceedings.  
 23 As we have put before you, there is evidence of  
 24 manipulation of the flow of the waters of the Chenab  
 25 River on more than one occasion, in breach of the

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09:56 1 issues, such as how to address, on a regional basis, the  
 2 environmental challenges that we both face, it will be  
 3 important that there is certainty and clarity in the  
 4 rules and obligations that bind us. The issue before  
 5 you in this phase of the proceedings engages perhaps  
 6 the last remaining point of uncertainty about how  
 7 the Parties must calculate maximum pondage.  
 8 Although this is not the only issue that has beset  
 9 relations between the Parties under the Treaty over the  
 10 past two decades, it is one of the most fractious, as  
 11 the volume of water contained in the operating pool --  
 12 the pondage to which India is entitled -- is a visible  
 13 manifestation, for all to see, of whether the Treaty is  
 14 working or not.  
 15 As you come to deliberate on the issues that remain  
 16 for your elaboration, there may be an inclination to  
 17 leave what may be perceived to be elements of  
 18 flexibility in the interpretative guidance that you  
 19 should give, leaving to the Parties discussion of  
 20 aspects of the calculation going forward. If leaving  
 21 elements of flexibility is unavoidable, so be it, but  
 22 I would encourage you to close off as many avenues of  
 23 uncertainty as you are able to do at this point in time  
 24 and process. Flexibility and uncertainty are  
 25 bedfellows, and the Parties' dispute about the

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<p>09:58 1 application of the Treaty is too deep to leave open 2 issues of design contention if this can possibly be 3 avoided. 4 Pakistan's counsel will address these issues 5 further, but I would like to leave you with a sense, 6 from my vantage point, that as complete an analysis of 7 the issues now before you is important. 8 The immediate purpose and time constraint on these 9 proceedings is to complete the analysis left open by 10 your General Issues Award on the calculation of maximum 11 pondage for purposes of necessary guidance to the 12 Neutral Expert. As Mr Bethlehem will address shortly, 13 there is a further phase scheduled before the Neutral 14 Expert which will be focused on the award that you will 15 issue in these proceedings. To this end, the hope is 16 that you will be able to address the outstanding issues 17 with reasonable expedition, although this is of course 18 a matter for you. 19 It is unusual in an inter-state arbitration to see 20 a series of awards and decisions from the [Court], on 21 issues of heavy moment, of such sagacity, efficiency and 22 dispatch. Pakistan is grateful for the Court's engaged 23 attention to these issues, even when you disagree with 24 our arguments and send us back to the drawing board. 25 As we said in the concluding paragraphs of our</p> <p style="text-align: center;">Page 13</p>	<p>10:02 1 the importance of these proceedings: as a full stop to 2 the interpretative phase of the proceedings; as a baton 3 change, handing the issues to the Neutral Expert for his 4 decision in respect of the KHEP and the RHEP; and 5 perhaps as a prelude to further proceedings to come on 6 different elements of the dispute of which you are 7 seised. We will come to such elements, Mr Chairman, as 8 you have mentioned, in the concluding session of this 9 hearing tomorrow. And as you've noted, you are in 10 receipt of Pakistan's submissions transmitted yesterday 11 that address this aspect, and I will reserve any further 12 comment on those issues to the closing session tomorrow. 13 Mr Chairman, before I start my scripted submissions, 14 perhaps let me just address the point that you closed 15 your opening introductory remarks with: the reference to 16 PO19 and the directions that were given to Pakistan to 17 communicate the details of the documents that we have 18 identified to India. 19 As I recall, in PO19 you also directed that Pakistan 20 should inform the Court of the steps that were taken, 21 although not copy the documents to the Court. I can 22 inform the Court that as of yesterday, Pakistan 23 transmitted the details to the Government of India on 24 multiple channels: first of all, on channels of the 25 Agent, from the Attorney General; second, on Indus</p> <p style="text-align: center;">Page 15</p>
<p>09:59 1 Memorial, these proceedings and those before the Neutral 2 Expert, from both of which India has absented itself, 3 are not tilting at windmills or scratching at sores or 4 using adjudicatory proceedings gratuitously as a cudgel 5 to advance grievances. They reflect an appreciation on 6 Pakistan's part that the law matters, and that the 7 application of the Treaty must be upheld in spirit, in 8 word and in deed. We hope, on the basis of your awards 9 and decisions, to find a pathway back to cooperation 10 under the Treaty. We are convinced that your 11 proceedings, and your decisions and award, provide very 12 important stepping-stones to do so. 13 Mr Chairman, members of the Court, that brings my 14 brief remarks to a close. May I ask you to call 15 Sir Daniel Bethlehem to the podium to continue 16 Pakistan's submissions in these proceedings. 17 THE CHAIRMAN: Thank you very much, Mr Awan, for those 18 opening remarks, which are much appreciated. 19 Sir Daniel, I believe it's now for you to take 20 the floor. 21 SIR DANIEL: Mr Chairman, members of the Court, members of 22 the Secretariat, it's an honour to appear before you 23 again on behalf of Pakistan and to be in this room for 24 the Second Phase on the Merits. 25 You have heard from the Attorney General about</p> <p style="text-align: center;">Page 14</p>	<p>10:03 1 Waters Commissioner channels; and this morning, on 2 diplomatic channels as well. 3 We have identified three documents in those 4 communications to the Government of India. If India 5 replies but does not submit the documents, or does not 6 reply, we invite you to ask us to address the documents 7 in question before any further order is made. 8 We note, Mr Chairman, your observation, and that in 9 PO19, that in the course of these proceedings we should 10 address precisely the kind of order that we would be 11 looking for, and we propose to do so in due course. 12 Mr Chairman, members of the Court, turning to 13 the scheme of our submissions. 14 My submissions this morning are going to be 15 relatively brief. I expect to be on my feet for about 16 45 minutes or so, and happily to hand off the bulk of 17 the detailed arguments to my colleagues, whom you know 18 well. 19 I will set out the scheme of our submissions to come 20 in just a moment. Before I do so, however, let me 21 recall the scope of these proceedings, both their 22 intended focus and also what is beyond them. And 23 I would also like to touch upon a point made in our 24 Memorial about Pakistan's case today in these 25 proceedings.</p> <p style="text-align: center;">Page 16</p>

<p>10:05 1 The issues before you in this Second Phase are 2 narrow, certainly narrow by reference to the general 3 issues submissions that we put to you almost two years 4 ago and in respect of which you issued your General 5 Issues Award last August. Given your analysis of the 6 methodology applicable to the calculation of maximum 7 pondage, two key linked elements remain. 8 The first is the basis on which India must determine 9 the installed capacity and anticipated load of 10 a proposed Annexure D, Part 3 HEP. The essence of this 11 enquiry is whether the Treaty imposes constraints on 12 what might otherwise be regarded as matters for 13 unilateral decision by India; and if it does impose 14 constraints, what those constraints are, and how they 15 operate to inform India's determination of installed 16 capacity and anticipated load. 17 The second element, once we have an answer to that 18 first question, is how installed capacity and 19 anticipated load are to be taken into account for 20 purposes of the calculation of maximum pondage. 21 So step 1 is the Treaty-mandated framework on 22 the determination of installed capacity and anticipated 23 load; and step 2 is applying this determination to 24 the calculation of maximum pondage. 25 Both enquiries turn on questions ultimately of</p> <p style="text-align: center;">Page 17</p>	<p>10:08 1 perspective, the issues covered in Chapter 3C to 3F of 2 our Memorial. Dr Miles will be on his feet for about 3 90 minutes or so, we expect. 4 Dr Miles will be followed by Mr Peter Rae, who will 5 address, from an engineering perspective, the issues 6 covered in Chapter 3C to 3F of the Memorial, as well as 7 in Appendix D, which addresses the matters from 8 an engineering perspective. Mr Rae will also make some 9 observations on the Court's Excel table -- Mr Chairman, 10 you'll forgive me if I don't remember your shorthand for 11 that -- but the Court's Excel table, which is addressed 12 in Chapter 4 of our Memorial. We expect that Mr Rae 13 will also be on his feet for about 90 minutes or so. 14 If there is any time remaining at the end of this, 15 I may come back to make some very brief closing 16 observations, although those might sensibly also be held 17 over to our closing submissions tomorrow afternoon. 18 So this is the scheme to come from us over the 19 remainder of the day. 20 If prologue is future, we not only expect questions, 21 but we welcome your questions and your comments during 22 the course of today. We will attempt to address those 23 that we can address on our feet. If, for reasons of 24 time or for reasons of an inclination to defer to 25 further consideration, we defer to the closing session</p> <p style="text-align: center;">Page 19</p>
<p>10:07 1 treaty interpretation, although with important 2 engineering elements to feed into the exercise. In 3 other words, they are rooted in the text of the Treaty: 4 what the Treaty says, what was intended by the Treaty, 5 how the Treaty works, and so on. This said, the Treaty 6 intended to apply engineering principles, a point that 7 you underlined in your General Issues Award, and it must 8 be capable of application in engineering terms, so 9 an engineering appreciation of the issues will be 10 critical. 11 We have formulated our submissions to address both 12 elements. We will lead off with submissions on the 13 applicable legal framework of the Treaty, and follow 14 these with submissions on engineering elements. 15 To this end, following me, Professor Webb -- who, 16 I should recall for the record, is our newly appointed 17 but not yet anointed King's Counsel -- will make 18 submissions that go principally to legal interpretative 19 issues, broadly following the scheme of what is 20 addressed in Chapter 2 and Chapter 3A and 3B of our 21 Memorial. She will speak about for 75 minutes, 22 we expect. 23 She will be followed by Dr Cameron Miles, who will 24 act as a bridge between the legal issues and the 25 engineering issues. He will address, from a legal</p> <p style="text-align: center;">Page 18</p>	<p>10:10 1 tomorrow afternoon, we will be sure not to lose sight of 2 the issues that you raise. 3 Beyond the key elements of the present enquiry that 4 I've just identified, there are other issues which arise 5 in the margins which will also warrant comment. We 6 will, for example, have something to say on what we 7 understand the Court's General Issues Award to have 8 concluded on the role of paragraph 15, the operational 9 constraints in paragraph 15 on the calculation of 10 maximum pondage. We will also touch on the issue of 11 environmental flow, although this for purposes of 12 identifying its relevance rather than for purposes of 13 addressing any issues of detail. 14 Mr Chairman, members of the Court, this brings me to 15 a contextualisation point that I make gingerly, but 16 nonetheless consider that it needs to be made. 17 Pakistan's case on pondage in the First Phase on the 18 Merits was that installed capacity and anticipated load 19 were not properly part of the maximum pondage 20 calculation. We strove, in advance of our Memorial on 21 the Merits in the First Phase, over a very considerable 22 period of time, to go back to first principles to 23 identify what we considered to be an interpretation of 24 the Treaty that was consistent with its terms, that was 25 workable through an engineering lens, and the outcome of</p> <p style="text-align: center;">Page 20</p>

<p>10:11 1 which would leave the Parties with certainty.                  2 We were driven in that endeavour to go back to first                  3 principles by an appreciation that the interpretation                  4 advanced by, and the practice of, both Parties in the                  5 preceding decades was not satisfactory, nor reliable,                  6 nor workable. This applied to the position advanced                  7 historically by both India and by Pakistan.                  8 As we recalled in our Second Phase Memorial, we were                  9 transparent before the Court in the First Phase in                  10 lifting the veil our attempts to identify, as I have                  11 said, an interpretation of the Treaty that was                  12 consistent with its terms, was workable from                  13 an engineering perspective, and arrived at an outcome                  14 that was clear and certain.                  15 Given your General Issues Award, we evidently failed                  16 in that endeavour, as the Court was not persuaded by our                  17 submissions. And as we've said now on multiple                  18 occasions, both in correspondence and in submissions,                  19 and I say now in this hearing, we accept this fully and                  20 in good faith, the Court's Award on these issues.                  21 But in doing so, as we come to this Second Phase --                  22 and this is the point that I make with ginger                  23 apprehension -- we remain troubled by the approach that                  24 the Court has adopted, possibly because we don't yet                  25 fully apprehend how it will operate, but also, more</p> <p style="text-align: center;">Page 21</p>	<p>10:15 1 calculation of maximum pondage.                  2 In your General Issues Award analysis on pondage,                  3 you addressed in careful and impressive detail, amongst                  4 other things, the ordinary meaning of the text of                  5 paragraph 8(c) and its interaction with paragraphs 2(c),                  6 2(i), 15 and other provisions of the Treaty. In doing                  7 so, you rejected Pakistan's interpretation as                  8 problematic on, amongst other grounds, that it rested on                  9 the contention that the Treaty-drafters left the time                  10 element in paragraph 8(c) -- and I quote here from your                  11 Award -- "to be inferred from provisions other than                  12 Paragraph 8(c) and its definitions". That's in                  13 paragraph [675] of your General Issues Award.                  14 This is of course not simply fair criticism of our                  15 approach, but this was an issue that Pakistan had itself                  16 identified transparently in its submissions to you on                  17 this aspect as being something that the Treaty did not                  18 address, and required inference. So you put your finger                  19 on the challenge of inference.                  20 I note this point not to pour salt on our wounds or                  21 to scratch at this particular issue unnecessarily,                  22 because we absolutely accept the Court's critique --                  23 it is accurate, as we explained going into the                  24 submissions -- but I do so for purposes of shining                  25 a light on the challenge that we consider persists into</p> <p style="text-align: center;">Page 23</p>
<p>10:13 1 importantly, because we perceive that, even on the                  2 elements on which the Court has given clear guidance --                  3 such as the "realistic, well-founded, and defensible"                  4 standard -- there is significant scope for future                  5 dispute.                  6 In saying this, we do not quibble about whether the                  7 methodology adopted by the Court may give a greater                  8 volume of pondage to India than would have been the case                  9 on Pakistan's proposed methodology. Questions going to                  10 this point, if at all, will turn on the approach that                  11 the Court adopts following the Second Phase of the                  12 proceedings, in your deliberations to come and your                  13 award to come.                  14 Our principal concern, as the Attorney General has                  15 said, is to secure an outcome that is as clear and as                  16 certain as possible, and as simple and as                  17 straightforward as possible. The more there are moving                  18 parts in the methodology, the more problems will be                  19 stored up for the future.                  20 With this in the forefront of our minds, we have                  21 come to you in this phase of the proceedings, both in                  22 our written submissions and now in the oral submissions                  23 to come, with what we think is the simplest, more                  24 straightforward and most appropriate approach to filling                  25 in the gap in the general issues analysis on the</p> <p style="text-align: center;">Page 22</p>	<p>10:16 1 the present phase.                  2 Prescribing the basis on which India must determine                  3 the installed capacity and anticipated load of                  4 a proposed Annexure D, Part 3 HEP will require                  5 an exercise of inference on your part. You took a view                  6 on the challenges of inference with respect to                  7 Pakistan's approach in the First Phase, but we have come                  8 to a position where an exercise of inference will still                  9 be required.                  10 The issue of how to determine installed capacity and                  11 anticipated load of a proposed Annexure D, Part 3 HEP is                  12 not addressed in the Treaty, and various terms are left                  13 undefined. Nor does the Treaty address how installed                  14 capacity and anticipated load are to be taken into                  15 account for purposes of the calculation of maximum                  16 pondage. The Court, in its pondage analysis, rejected                  17 one approach that rested on inference but opted for                  18 another, and one that portends less certainty than                  19 the approach that was rejected.                  20 Now, we are where we are, and we acknowledge this                  21 and we fully accept this. I make the point only to                  22 shine a light on the challenges of inference and to                  23 emphasise the premium that Pakistan attaches to the                  24 objective of achieving certainty in the Parties'                  25 obligations under the Treaty.</p> <p style="text-align: center;">Page 24</p>

10:18 1 Let me turn briefly to address the relevance of  
 2 these proceedings to the Neutral Expert proceedings.  
 3 In the fourth meeting of the Neutral Expert that  
 4 took place in Vienna from 17 to 21 November last year,  
 5 we addressed the Neutral Expert at length on the content  
 6 of your General Issues Award, and its relevance and  
 7 application to the enquiry of which the Neutral Expert  
 8 is seised in respect of the KHEP and RHEP. In doing so,  
 9 we of course addressed the Court's analysis and findings  
 10 on pondage, and we affirmed explicitly and on the record  
 11 Pakistan's full acceptance of your Award in all of its  
 12 aspects, including, of course, in respect of pondage.  
 13 As your Procedural Order No. 17, defining the scope  
 14 of this Second Phase on the Merits, was issued in  
 15 advance of Pakistan's closing submissions to the Neutral  
 16 Expert on 21 November, we placed your procedural order  
 17 before the Neutral Expert specifically and informed him  
 18 of the scope and timings of the proceedings to come  
 19 before the Court. We further requested the Neutral  
 20 Expert to revise his work programme to enable  
 21 submissions from the Parties that would address the  
 22 terms of your Award on pondage and its relevance and  
 23 application to the Neutral Expert's task.  
 24 The Neutral Expert's most recently revised work  
 25 programme is now on the screen; I hope that it is

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10:21 1 a couple of weeks, we don't expect that we will seek  
 2 longer. But this date will be fixed by reference to the  
 3 timing of the Court's award on pondage in this  
 4 Second Phase.  
 5 I develop on this point just to put on your radar  
 6 screen, if it is not already, that as soon as you are  
 7 able to give us an indication of a likely timing of your  
 8 award in this Second Phase, that will allow us to  
 9 address issues of timing in the parallel Neutral Expert  
 10 proceedings. I think in our correspondence to you, if  
 11 memory serves me correctly, in which we requested this  
 12 further phase, we, as a matter of hypothesis, speculated  
 13 as to whether it may be possible for the Court to issue  
 14 its award perhaps by 13 April. But that of course is  
 15 a matter for you, and we are more concerned that you  
 16 take the time to get the issues right than that you  
 17 constrain yourself artificially by a deadline.  
 18 We then move to item 14 on the Neutral Expert's work  
 19 programme. You can see there that's a date set, a date  
 20 certain, 5 to 7 May. That's a fifth meeting of the  
 21 Neutral Expert, where the expectation is that there will  
 22 be an oral presentation of the written submissions on  
 23 pondage.  
 24 As the Neutral Expert -- and this is clear from his  
 25 decisions on the record of your proceedings, and which

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10:20 1 visible to you. You will no doubt be very familiar with  
 2 it already, so I will not dwell upon it long. But  
 3 I simply note where we are and where we expect to be in  
 4 the coming months.  
 5 If you have a look at item 12, which is now at the  
 6 top of the screen, that addressed the fourth meeting  
 7 that took place between 17 and 21 November: presentation  
 8 of memorials, questions from the Neutral Expert. It was  
 9 over five days, but there were four days of hearings.  
 10 We are now in the interregnum between item 12 and  
 11 item 13. So we move then to item 13, which contemplates  
 12 the Parties' further written submissions on pondage from  
 13 the Parties, with a date to be determined in late  
 14 April 2026.  
 15 Now, we have written explicitly to the Neutral  
 16 Expert, this is well known -- your documents are also on  
 17 the record -- to say that of course our written  
 18 submissions on pondage will be dependent on the timing  
 19 of your award coming out of this phase. We have  
 20 indicated to the Neutral Expert -- or if not, this is  
 21 certainly our apprehension of our approach -- that once  
 22 you issue your award in this Second Phase, we will  
 23 endeavour to make written submissions to the Neutral  
 24 Expert extremely quickly. So we are not planning to sit  
 25 on our hands. Whether it's the space of a week or

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10:23 1 are now publicly available -- as is clear from the  
 2 appreciation of the Neutral Expert, for example, on the  
 3 issue of Pakistan's bifurcation application, the Neutral  
 4 Expert apprehended that certainty on the issue of the  
 5 methodology for the calculation of pondage would be  
 6 relevant for his consideration of all other aspects as  
 7 well: the placement of intakes, the location of  
 8 spillways and so on. So the fifth meeting, we expect,  
 9 over the course of three days, is likely to address not  
 10 just the pondage issues but also the wider implications  
 11 for other aspects of the Neutral Expert's enquiry.  
 12 That date, of course, is fairly quickly following  
 13 the TBD date of late April 2026 for the written  
 14 submissions on pondage; and again, those are going to be  
 15 contingent on the timing of the Court's award.  
 16 So these are the Neutral Expert's work programme  
 17 items that are immediately dependent on the outcome of  
 18 the present proceedings before the Court.  
 19 While we have the work programme on the screen, let  
 20 me briefly take you through the subsequent stages of his  
 21 proceedings. I'm sure you have them closely in mind  
 22 because they have been raised in correspondence with you  
 23 dealing with other things, but just to tick these issues  
 24 off.  
 25 So by 1 June, recalling -- if one could just scroll

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10:25 1 up to see item 14 again. So item 14 was 5 to 7 May,  
 2 which was the fifth meeting, addressing issues of  
 3 pondage and other consequential issues.  
 4 By 1 June, we expect to see the Neutral Expert's  
 5 synthesis memorandum. We anticipate that the synthesis  
 6 memorandum will be a recollection in an organised form  
 7 of the Parties' submissions on all of the various  
 8 issues, not reaching conclusions but simply setting out  
 9 the essence of the Parties' arguments.  
 10 There will be an opportunity then that follows by  
 11 30 June, so almost a month later, for the Parties to  
 12 comment on the synthesis memorandum. We expect that  
 13 those comments are likely to be limited to and focusing  
 14 on the completeness and accuracy of the Neutral Expert's  
 15 appreciation of the Parties' issues, but not to make any  
 16 comments of substance.  
 17 We then have a meeting window in reserve in  
 18 early/mid-July, in case this is needed.  
 19 Item 18, circulation by the Neutral Expert of  
 20 a draft decision to the Parties by 30 September.  
 21 Then a series of steps, item 19, item 20 and  
 22 item 21, which may appear to be a little bit cumbersome:  
 23 the Parties' draft comments on the draft decision;  
 24 a meeting of the Neutral Expert to address the exchange  
 25 of the draft decision; and then the Parties' further

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10:28 1 constraints, and the Court indeed has already identified  
 2 a number of such constraints. Professor Webb will  
 3 address this issue in more detail, so I am just the  
 4 taster.  
 5 My first observation is that, distinct from its  
 6 design criteria obligations, India is required, it is  
 7 mandated, it is obligated to communicate to Pakistan key  
 8 information regarding any proposed Annexure D, Part 3  
 9 HEP. You will be very familiar with these provisions  
 10 from the First Phase, but for ease of recollection, we  
 11 have now on the screen the text of paragraphs 9 to 12 of  
 12 Annexure D, and in just a moment we will also put up  
 13 the text of Appendix II to Annexure D.  
 14 Looking first at paragraph 9, this imposes  
 15 an obligation upon India to communicate to Pakistan in  
 16 writing the information specified in Appendix II.  
 17 The timing of this obligation is important. And I just  
 18 pause here to recollect that in your General Issues  
 19 Award, you dwelt on this issue of the six months timing  
 20 in paragraph 9, and as I recall, you emphasised that  
 21 this was a minimum, not a maximum, and indeed there was  
 22 encouragement in your General Issues Award to India to  
 23 communicate the necessary information to Pakistan as  
 24 early as possible.  
 25 But my point here is not just to focus on the issue

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10:26 1 written comments. These are all already built in to the  
 2 Neutral Expert's supplemental rules of procedure, which  
 3 of course is also public, and therefore are required.  
 4 Then on 29 January 2027, the expectation that  
 5 the Neutral Expert will circulate his final decision to  
 6 the Parties.  
 7 Now, I say no more about this at this stage. These  
 8 are issues that we may wish to come back to in the  
 9 closing case management discussion at the end of the  
 10 hearing tomorrow because they are relevant to the  
 11 further possible next steps, including a potential  
 12 application for interim measures. So I set these out so  
 13 you have a sense of the trajectory to come in the  
 14 Neutral Expert proceedings.  
 15 We can take that off the screen, thank you.  
 16 So I turn now to some brief observations on the  
 17 issue of Treaty-based limitations on India's margin of  
 18 appreciation in the determination of installed capacity  
 19 and anticipated load.  
 20 Going back to the first part of the enquiry with  
 21 which this phase of the proceedings is concerned,  
 22 whether the Treaty imposes constraints on India's margin  
 23 of appreciation when it comes to the determination of  
 24 installed capacity and anticipated load, it is of course  
 25 Pakistan's position that the Treaty does indeed impose

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10:30 1 of the six months, but that it says six months in  
 2 advance "of the construction of river works connected  
 3 with the Plant". This is not about six months in  
 4 advance of concreting up to the level of intakes or of  
 5 other advanced-stage work on construction. It is  
 6 six months in advance of the construction of river  
 7 works: taking a spade, putting it into the sand. There  
 8 must be an opportunity for Pakistan to receive  
 9 information and comment on the information received.  
 10 If we turn now to Appendix [II]. Again, you'll be  
 11 very familiar with this, and I don't propose that we  
 12 enlarge the screen to focus on the issues, but just to  
 13 look through it briefly.  
 14 The information that India is obliged to communicate  
 15 to Pakistan is detailed. Apart from the location of the  
 16 plant, it requires hydrologic data to be communicated,  
 17 hydraulic data, particulars of design -- which is going  
 18 to be most important for purposes of this phase of the  
 19 proceedings -- and other data. And the specified data  
 20 and information includes data addressing, of course,  
 21 the hydrology of the river, and data relevant to the  
 22 projected installed capacity and anticipated load of  
 23 the plant.  
 24 You will see that, in particular, in the particulars  
 25 of design under paragraph 4, around subparagraphs (h)

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10:31 1 and (i), but there will be others that are relevant as  
 2 well, and my colleagues will take you to these  
 3 provisions in closer detail.  
 4 While we are there, I also note incidentally that  
 5 India, by paragraph 5(a) of Appendix II, is also obliged  
 6 to provide to Pakistan a detailed estimated effect of  
 7 the proposed development of the flow pattern below  
 8 the last plant downstream. So it's not just the  
 9 hydrology of the river upstream, it's not just detail of  
 10 the works, it's not just the works themselves, but also  
 11 the consequential implications downstream. And  
 12 obviously that is going to be relevant when it comes to  
 13 questions of environmental flow or minimum flow.  
 14 I note just in passing that of course environmental  
 15 flow and minimum flow, whilst they might overlap,  
 16 essentially address two different issues. I think in  
 17 the Kishenganga Court's final award, there may be  
 18 a little bit of eliding of the two concepts into the  
 19 notion of environmental flow, but they do address two  
 20 different things.  
 21 Going back to paragraphs 10 and 11 of Annexure D,  
 22 paragraph 10 then provides that Pakistan must have  
 23 an opportunity to object that the proposed design does  
 24 not conform to the criteria mentioned in paragraph 8.  
 25 And I note in passing that there is no mention here of

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10:35 1 in the information communication, objection and  
 2 challenge procedures, an expectation that the  
 3 information that India is required to communicate to  
 4 Pakistan must be capable of being tested. And it must  
 5 be capable of being tested, we say, not simply on  
 6 procedural grounds -- "You haven't provided this, or you  
 7 haven't provided it sufficiently" -- but also as regards  
 8 its content.  
 9 Professor Minear, I anticipated that you might have  
 10 a question? No, you were just leaning forward eagerly.  
 11 It is additionally the case that paragraph 12 makes  
 12 it clear that once India has passed the initial  
 13 paragraph 9 information gateway, it cannot simply make  
 14 changes to its design at will, without communication to  
 15 Pakistan. Paragraph 12 requires that India has to come  
 16 back to Pakistan if there are changes to be made in due  
 17 course, must communicate the changes and the relevant  
 18 information, and that the process of objection and  
 19 potential challenge arises as well, applies as well, but  
 20 within a more accelerated timescale: three months  
 21 instead of six months.  
 22 Seen through this prism, it is clear that these  
 23 provisions both impose and imply constraints on India's  
 24 latitude to unilaterally, without limit, determine the  
 25 particulars of design. Going back to Appendix II, this

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10:33 1 paragraph 15, of the operational constraints issue,  
 2 which suggests that insofar as paragraph 15 is relevant  
 3 as part of the design enquiry -- which you have found to  
 4 be the case, and which we of course accept -- that it is  
 5 contingent on the paragraph 8 design criteria, operating  
 6 as a design compliance constraint rather than as  
 7 a gateway design criterion.  
 8 Paragraph 11 then provides that any objection by  
 9 Pakistan may be resolved by reference to the Article IX  
 10 settlement modalities, including, of course, through  
 11 proceedings before a court of arbitration or a neutral  
 12 expert.  
 13 Pausing here, it is axiomatic, we say, that if  
 14 detailed specified information must be communicated to  
 15 Pakistan under paragraph 9, if Pakistan must have  
 16 an opportunity to object pursuant to paragraph 10 and if  
 17 dispute resolution modalities are prescribed pursuant to  
 18 paragraph 11, it must follow that the Treaty  
 19 contemplates a review process that is more than merely  
 20 procedural by reference to which objections to design  
 21 compliance can be tested. If not, these provisions  
 22 would be entirely ineffective. And this process must,  
 23 of course, apply also to objections in respect of  
 24 installed capacity and anticipated load.  
 25 So we have implicit in the structure of the Treaty,

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10:37 1 extends to -- perhaps we can have the next slide again  
 2 back on the screen and zoom in on paragraph 4,  
 3 the particulars of design.  
 4 So going back to Appendix II, this extends to,  
 5 amongst other elements, a review of the "discharge  
 6 proposed to be passed through the Plant", of India's  
 7 "expected variations in the discharge on account of the  
 8 daily and weekly load fluctuations", and of the proposed  
 9 "maximum aggregate capacity of power units" for firm  
 10 power and secondary power. That's there in Appendix II.  
 11 Professor Webb will address these issues further.  
 12 In your General Issues Award, you identified  
 13 a number of constraints upon India with respect to such  
 14 an exercise -- we can take the slide off the screen,  
 15 thank you. So you identified a number of constraints  
 16 upon India with respect to such an exercise, and  
 17 Professor Webb will address these issues more fully.  
 18 I note only at this point two principles that  
 19 you identified: first, that India must undertake  
 20 a realistic, well-founded and defensible projection of  
 21 a proposed HEP's installed capacity and anticipated  
 22 load. And you will recall, because this was one of  
 23 the issues that was centre-stage in our request for  
 24 clarification, your reaffirmation that the standard was  
 25 a realistic, well-founded and defensible projection.

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10:38 1 And the second principle, and that has also arisen in  
 2 subsequent correspondence, is that the projection of  
 3 installed capacity and anticipated load must correspond  
 4 to how the HEP will actually be operated, and cannot be  
 5 hypothesised in a manner that serves to inflate the  
 6 amount of maximum pondage.  
 7 Now, it is Pakistan's case that the evidence on  
 8 the record of these proceedings clearly indicates that  
 9 India, almost as a default approach, as seen through its  
 10 historic practice -- about which you will hear a good  
 11 deal shortly -- routinely hypothesises its projected  
 12 installed capacity and anticipated load precisely to  
 13 inflate the amount of pondage to which it says it is  
 14 entitled. And as I say, we will come back to this  
 15 shortly.  
 16 As the Court is aware from the PO19 correspondence,  
 17 there is significant relevant evidence in support of  
 18 this contention that is not yet before the Court. In  
 19 the event that that evidence comes before the Court  
 20 through the PO19 process, Pakistan will readily make  
 21 good on this contention.  
 22 Assuming, arguendo, for the moment, that our  
 23 contention -- the contention that I have just made --  
 24 has weight, the question that follows is: how can  
 25 India's proven historic overreach in the projection of

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10:42 1 addresses the issue of ab initio, at-the-outset  
 2 compliance, applies expressly, in paragraph 811(S), to  
 3 the communication of information pursuant inter alia to  
 4 paragraph 9.  
 5 The question that follows from this is: how can  
 6 the Court's injunction requiring India to undertake  
 7 a realistic, well-founded and defensible projection of  
 8 installed capacity and anticipated load be tested from  
 9 the outset? Without more from the Court on this, there  
 10 is a real risk that this test identified by the Court --  
 11 "realistic, well-founded, and defensible" -- there is  
 12 a real risk that these will simply be warm words,  
 13 hortatory but with few teeth, and operating as a fertile  
 14 source for future dispute.  
 15 Something more is required: something clear,  
 16 precise, practical in its application, and properly  
 17 reflective of the clear differentiation that the Court  
 18 has itself made, in its wider analysis, of the  
 19 centrality of ab initio design compliance, distinct from  
 20 post-commissioning operational constraints.  
 21 Mr Chairman, members of the Court, I think it's  
 22 always the duty of lead counsel, speaking first, to  
 23 speak gingerly, and I do so, with the next point, with  
 24 humility and with the utmost of genuine respect to the  
 25 Court. But we perceive there to be a real risk that the

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10:40 1 installed capacity and anticipated load, for the evident  
 2 purpose of inflating maximum pondage, how can India's  
 3 proven historic overreach be addressed from the  
 4 outset -- in other words, at the design stage -- as  
 5 opposed to having to wait for multiple years of logbook  
 6 operational data?  
 7 In this regard, I recall the Court's finding in your  
 8 Clarification Decision at paragraph 88(F) -- that's part  
 9 of the dispositif -- that the paragraph 8 design  
 10 criteria are, first of all, mandatory; second, they are  
 11 to be applied at the outset, in other words, at the  
 12 planning stage as opposed to the construction stage;  
 13 third, that they are distinct from post-commissioning  
 14 operational constraints; and fourth, that they cannot be  
 15 satisfied by a commitment to operational constraint.  
 16 Your General Issues Award did not, of course,  
 17 address the projection of installed capacity and  
 18 anticipated load. But the ab initio principle that  
 19 these design issues need to be satisfied at the design  
 20 stage, and that they are separate from the operational  
 21 constraints, this ab initio principle expressed by the  
 22 Court is fundamentally apposite to the enquiry in which  
 23 you are now engaged.  
 24 And indeed, the Court's dispositif at  
 25 paragraph 811(S) of your General Issues Award, which

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10:43 1 approach on pondage to which the Court gravitated in its  
 2 General Issues Award may come to be, or risk coming to  
 3 be, as a matter of interpretative principle, out of step  
 4 with the Court's approach as regards the other  
 5 paragraph 8 design criteria and the information  
 6 communication obligations relevant to these criteria.  
 7 India's pondage design obligations must be capable  
 8 of Treaty compliance evaluation at the outset, at the  
 9 design phase, at the point at which India communicates  
 10 the information it is required to provide to Pakistan;  
 11 not five years after the fact, when we've got the  
 12 logbooks and we see that the pondage claimed and awarded  
 13 has not been used.  
 14 In Pakistan's assessment, the key considerations in  
 15 assessing whether a projection of installed capacity and  
 16 anticipated load is realistic, well-founded and  
 17 defensible will be whether the projections are  
 18 calibrated, first, to the hydrology of the site of the  
 19 proposed HEP -- it's all about the water, ultimately --  
 20 and second, to a testable, evidence-based projection of  
 21 the contribution of the HEP to the grid to which it is  
 22 connected.  
 23 If the Court's twin pillars of a realistic,  
 24 well-founded and defensible projection, and a projection  
 25 that cannot merely be hypothesised but must correspond

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10:45 1 to how the HEP will actually be operated, if these twin  
 2 pillars are to be meaningful, it will be necessary for  
 3 Court to spell out in detail the information that will  
 4 be required of India to meet these tests, and not just  
 5 to identify that India has the burden of proof but to  
 6 identify as well that there will be a presumption of  
 7 Treaty incompatibility if India either does not meet the  
 8 tests or fails to provide a sufficiency of information  
 9 to enable Pakistan to assess whether the tests are met.  
 10 Mr Chairman, members of the Court, Pakistan's final  
 11 submissions in its Memorial for this phase provide  
 12 detail on what Pakistan proposes should be read into  
 13 your "realistic, well-founded, and defensible" test.  
 14 It, on reflection, however, omits to request the Court  
 15 to explicitly elaborate on the information that will be  
 16 required of India to meet this test, and that  
 17 a presumption of incompatible will operate if India  
 18 either fails to meet the test or fails to provide  
 19 a sufficiency of information. But we will remedy this  
 20 apparent oversight in the written final submissions in  
 21 the final submissions that we will make at the close of  
 22 the hearing tomorrow.  
 23 Mr Chairman, members of the Court, this brings me to  
 24 two brief concluding observations to make on the  
 25 connected issues of where paragraph 15 fits into the

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10:49 1 assessed paragraph 15 as "context" -- and I'm here using  
 2 "context" in its legal technical term, context being  
 3 appropriately used for purposes of Treaty  
 4 interpretation -- so you assessed paragraph 15 as  
 5 "context" for the interpretation of paragraph 8(c). And  
 6 you will find this discussion in, amongst other parts of  
 7 your award, paragraphs 682, 685, 738.  
 8 Addressing the object and purpose of the Treaty,  
 9 you concluded that paragraph 15 operates "once installed  
 10 capacity and anticipated load are identified"; that's at  
 11 paragraph 704. In other words, paragraph 15, and the  
 12 engagement of paragraph 15 in the design process,  
 13 follows the initial design enquiry with respect to  
 14 installed capacity and anticipated load.  
 15 Pakistan fully accepts the Court's analysis and  
 16 conclusions. As we understand it -- and this is the  
 17 position that is set out in our Memorial, and on which  
 18 Dr Miles and Mr Rae will elaborate -- paragraph 15  
 19 operates as a restriction on the storage of water, both  
 20 daily and weekly, that is relevant at the design stage  
 21 to ensure that the design of a HEP is calibrated to the  
 22 manner in which the HEP is able to be operated under  
 23 the Treaty.  
 24 Reflecting the Court's finding in its Clarification  
 25 Decision that paragraph 8 design criteria, which applied

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10:47 1 calculation and the relevance of environmental flow to  
 2 the calculation. Both Dr Miles and Mr Rae will say more  
 3 on these issues. My observations are simply to identify  
 4 points on the horizon -- and perhaps to attract your  
 5 fire, if there is fire to be attracted -- but to  
 6 identify points on the horizon that are relevant to your  
 7 consideration of the issue.  
 8 In your General Issues Award, you held as  
 9 a penultimate point of restriction -- and I underline  
 10 the "penultimate point of restriction" -- in the  
 11 approach to be taken to the calculation of maximum  
 12 pondage that pondage required for firm power shall be  
 13 calculated in a manner that abides by the daily and  
 14 weekly release requirements set out in paragraph 15 of  
 15 Annexure D. In reaching this conclusion, you stated  
 16 that "design and operation cannot be ... strictly  
 17 separated"; that's at paragraph 680 of your General  
 18 Issues Award, and you recalled a similar statement by  
 19 the Kishenganga Court to this effect.  
 20 You also went on to say that paragraph 15:  
 21 "... serves as a turbine discharge constraint that  
 22 must be considered in determining how to manage water  
 23 storage to meet the HEP's daily and weekly load  
 24 conditions."  
 25 That's at paragraph 681. In so concluding, you

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10:50 1 at the outset, must be distinguished from  
 2 post-commissioning operational constraints such as  
 3 paragraph 15 -- I should just go back over that.  
 4 We also understand from the Court's Clarification  
 5 Decision that the paragraph 8 design criteria, which  
 6 apply at the outset, must be distinguished from  
 7 post-commissioning operational constraints such as  
 8 paragraph 15. Pakistan does not, accordingly,  
 9 understand the Court to be saying in its General Issues  
 10 Award that paragraph 15 is itself a design criterion  
 11 that applies in headline terms before installed and  
 12 anticipated load are identified, but rather that it is  
 13 an operational constraint closely linked to the design  
 14 criteria that acts as a limit against potentially  
 15 overzealous design.  
 16 Now, I make this point in opening Pakistan's  
 17 submissions today as it is one of some considerable  
 18 importance, and if Pakistan's understanding of what the  
 19 Court intended with respect to the role of paragraph 15  
 20 is incorrect, we request that the Court clarify this  
 21 understanding to us in the course of this hearing, to  
 22 enable us to address the Court's more intended meaning  
 23 more fully.  
 24 This is Pakistan's understanding of what you decided  
 25 as regards paragraph 15. My colleagues will develop

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10:52 1 this more fully, in particular, Dr Miles. But if there  
 2 is an issue to be raised here, we would very much invite  
 3 Court's questions or clarifications, perhaps at the end  
 4 of today's session, in the segment set out for  
 5 questions.  
 6 I come lastly to the issue of e-flow. And in doing  
 7 so, Professor Buytaert, I acknowledge that this is one  
 8 amongst many areas of your special expertise. And  
 9 I have to say that we -- certainly I -- read with  
 10 interest, for example, your recent paper that you  
 11 co-authored on the hydrological impact of small  
 12 hydropower development on mountain rivers in Southwest  
 13 China and the role of environmental flows. So in my  
 14 brief remarks to come, I make the observations with  
 15 particular caution, not simply as a lawyer addressing  
 16 an engineer.  
 17 We have addressed the issue of e-flow briefly in our  
 18 Memorial. Dr Miles and Mr Rae will elaborate on these  
 19 issues a little further in their submissions.  
 20 Apart, however, from requesting the Court to  
 21 acknowledge in its award to come that pondage required  
 22 for firm power must be calculated in a manner that  
 23 abides by India's obligations to prevent significant  
 24 harm to the environment through provision of an  
 25 environmental flow specific to each HEP, apart from

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10:54 1 requesting that acknowledgement, we do not consider that  
 2 the Court needs to or indeed should elaborate on  
 3 a methodology for the calculation of environmental flow.  
 4 Indeed, we say that to do so would be a significant  
 5 endeavour in terms of time and cost, and would pose  
 6 serious analytical challenges, certainly to Pakistan and  
 7 to the Court, to assess e-flow considerations that may  
 8 arise some considerable way upstream on the Chenab, to  
 9 which Pakistan does not have physical access.  
 10 Further, while the issue of environmental flows does  
 11 arise with respect to the KHEP and the RHEP, India's  
 12 KHEP e-flow obligations were addressed by the  
 13 Kishenganga Court in its final award and are binding on  
 14 the Parties. With respect to the RHEP, Pakistan has not  
 15 objected to India's e-flow calculation of 33.3 cubic  
 16 metres per second.  
 17 We are also conscious that there is an array of  
 18 methodological approaches to the assessment of e-flow  
 19 requirements, and we do not think that it would  
 20 necessarily be useful for the Court to step into this  
 21 field with a view to trying to define an e-flow  
 22 methodology that could apply to all potential  
 23 Western River HEP sites.  
 24 This said, the singular concept in common to all  
 25 e-flow methodologies in perennial rivers is the

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10:55 1 requirement for some minimum continuous flow that must  
 2 be maintained at all times to avoid de-watering the  
 3 downstream riverbed.  
 4 In the context of the Indus Waters Treaty, where  
 5 there is a specific, bespoke framework, an environmental  
 6 flow will necessarily represent some portion of the  
 7 minimum mean discharge. It cannot be a flow rate in  
 8 addition to the MMD, as in the driest period the MMD  
 9 represents the totality of the river's flow.  
 10 Accordingly, an environmental flow can only be satisfied  
 11 from within the limits of the MMD rate. The requirement  
 12 for an e-flow cannot, therefore, inflate the volume of  
 13 water available for pondage, which is tied to the MMD,  
 14 but must rather be subtracted from the maximum pondage  
 15 to ensure a continuous flow of water, regardless of  
 16 pondage storage entitlements.  
 17 We would, of course, be happy to address this  
 18 further tomorrow, if you have any questions once you  
 19 have heard more on these issues from Dr Miles and  
 20 Mr Rae. You will also have seen, no doubt, and been  
 21 very consciously aware, in the submission that we filed  
 22 yesterday on further phases in the Court proceedings,  
 23 that we have reserved our position on whether it would  
 24 be necessary or warranted to request a further phase to  
 25 address e-flow issues.

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10:57 1 On our present assessment, we do not think that  
 2 this is warranted, and we invite the Court to limit its  
 3 findings on this issue to the acknowledgement that  
 4 pondage required for firm power must be calculated in  
 5 a manner that abides by India's obligations to prevent  
 6 significant harm to the environment through provision of  
 7 an environmental flow specific to each HEP site.  
 8 Mr Chairman, members of the Court, that concludes  
 9 my opening submissions. If there are any questions or  
 10 issues with which I can assist you, I would be happy to  
 11 do so. If not, Mr Chairman, I would ask you to please  
 12 invite Professor Webb to the podium to continue  
 13 Pakistan's submissions.  
 14 THE CHAIRMAN: Thank you, Sir Daniel.  
 15 Professor Minear has a question for you.  
 16 PROFESSOR MINEAR: Thank you, Sir Daniel, for that very  
 17 complete explanation of what we will be seeing over the  
 18 next two days.  
 19 I inferred from something you said -- and I think it  
 20 occurred at 10.46 of the transcript (page 41) -- that  
 21 Pakistan may be amending its proposed dispositif.  
 22 Is that correct?  
 23 SIR DANIEL: We have that in contemplation not to amend  
 24 the substance of what we have asked for specifically but  
 25 perhaps to add what may be implicit but not explicit in

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10:58 1 it, which is to ask you to address in full and granular  
 2 detail the information that must be required, and  
 3 perhaps to elevate from your Award, where you address  
 4 the issue of burden of proof upon India, to elevate that  
 5 into a dispositif and perhaps to characterise it as  
 6 a presumption.  
 7 So that's something that we do have in  
 8 contemplation. And as is not uncommon -- indeed,  
 9 entirely usual and required in the context of  
 10 inter-state arbitral proceedings or proceedings in  
 11 the other chamber -- the discipline of stating, or of  
 12 restating, or of amending final submissions at the close  
 13 of the proceedings is precisely to give the court or  
 14 tribunal clarity of what the applicant is asking for.  
 15 PROFESSOR MINEAR: Okay, thank you.  
 16 THE CHAIRMAN: Sir Daniel, I have a couple of questions for  
 17 you, and I think then we'll let you go. (Pause)  
 18 First, just to maybe make more of an observation  
 19 than a question. You, at a couple of points in your  
 20 presentation, gingerly put to us Pakistan's concern that  
 21 greater certainty is of value in resolving the issue of  
 22 maximum pondage, and I can certainly appreciate  
 23 Pakistan's interest in that, both with respect to the  
 24 First Phase and with respect to the Second Phase.  
 25 At the same time, as just an observation, the Court

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11:02 1 So I don't know if that helps indicate at least some  
 2 of my own thinking as to the Court's approach to the  
 3 Treaty, but I just thought I would gingerly offer those  
 4 reflections, in case it's of assistance to you.  
 5 SIR DANIEL: Thank you very much, Professor Murphy.  
 6 Let me react to that, because of course it is no  
 7 part of our submissions to encourage you into  
 8 a legislative exercise in Pakistan's interest. We fully  
 9 appreciate that in fact there are perhaps gaps in the  
 10 Treaty, perhaps there are uncertainties, whether by  
 11 design or by default, that cannot simply be wished away  
 12 through the fiat of an arbitral award.  
 13 But as you will recall from our written submission  
 14 in this phase, we did identify and address the  
 15 discussion in your General Issues Award where you in  
 16 fact put your finger on precisely this point and you  
 17 say, "Pakistan's initial submissions with respect to  
 18 pondage bring with them the merit of certainty, you get  
 19 to a number certain, but we don't think this is correct  
 20 as a matter of treaty interpretation", and you then go  
 21 through the analysis.  
 22 I suppose my observations made gingerly are really  
 23 counsel's attempt to leave a sense, when you come to  
 24 your deliberations, that we at least -- and this perhaps  
 25 may simply be our myopia about your thinking -- we at

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11:00 1 obviously is only able to interpret and apply the Treaty  
 2 that it has before it. Where that Treaty allows for  
 3 precision, the Court certainly is prepared to interpret  
 4 it to that effect. Where the Treaty doesn't provide for  
 5 precision, the Court must take the Treaty as the Parties  
 6 negotiated and adopted it.  
 7 So I suppose I'm just reacting a little bit to this  
 8 concern that the Court's approach with respect to  
 9 maximum pondage might be out of step with the other  
 10 paragraph 8 provisions. As you are well aware, those  
 11 provisions have some degree of certainty and precision  
 12 to them, but they leave a lot to application and  
 13 context, whether it's the height of particular outlets  
 14 or the height of freeboard or what have you.  
 15 So, at least from my perspective, what the Court is  
 16 attempting to do is to apply the Treaty that it has  
 17 before it as it relates to maximum pondage, which does  
 18 allow for some degree of precision, but at a certain  
 19 point it stops. And at that point, guidance can be  
 20 provided as to factors that are relevant, but at the end  
 21 of the day, on some level, there was an expectation in  
 22 the Treaty of good faith application by India, good  
 23 faith reaction by Pakistan to any design, and then  
 24 ultimately, if a dispute emerges, the possibility of  
 25 dispute resolution.

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11:04 1 least don't see the methodology that you have intimated  
 2 in respect of the calculation of maximum pondage  
 3 escaping from the problems of inference that you laid at  
 4 our doorstep when you rejected our certainty argument.  
 5 All treaties, if they are to be effective, have to  
 6 be certain in the context of the relationship between  
 7 the parties. We know that the Indus Waters Treaty arose  
 8 out of a fractious dispute in 1948 which has got very  
 9 similar overtones to the issues that are currently being  
 10 seen. We are not asking you or expecting you to fill in  
 11 the gaps where there are no gaps to be filled in. But  
 12 there will be judgments to be made, we think, when it  
 13 comes to your deliberations on this phase, where you may  
 14 be inclined to leave the door rather more widely open,  
 15 as to opposed to shut it more firmly on particular  
 16 issues.  
 17 The submissions of substance that we made in our  
 18 written Memorial and that you will hear from my  
 19 colleagues, in the six-step methodology, for example,  
 20 that we have proposed, have been driven by an imperative  
 21 on our side to try and identify a methodology that fits  
 22 within your general issues framework that is as simple  
 23 and as precise as we believe can be made, narrowing the  
 24 scope for further uncertainty and further dispute.  
 25 Now it may be -- and indeed, we ourselves are able

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11:07 1 to contemplate other possibilities -- that there are  
 2 other methodologies that could fit within that analysis  
 3 that would leave more to discretion, more to be resolved  
 4 by the good faith interaction between the Parties in due  
 5 course. And my finger on the scale is simply to say to  
 6 you, members of the Court, that in circumstances in  
 7 which you have a choice to make, you should err on  
 8 the side of certainty, not on the side of greater  
 9 flexibility, anticipating a good faith engagement of  
 10 the Parties on these issues. It's nothing more than  
 11 that. We accept that there is a lack of clarity in  
 12 particular on these aspects in the Treaty, but there may  
 13 be milestones to the inference that you can adopt, and  
 14 some of those milestones may take you further in  
 15 the direction of certainty than others.  
 16 THE CHAIRMAN: Thank you for those reflections.  
 17 I have a much less significant question, if you  
 18 will, for you: the issue of the document production  
 19 relating to this phase from the Neutral Expert's  
 20 proceedings.  
 21 Assuming that, in some fashion, at some point, those  
 22 documents come into these proceedings, is Pakistan  
 23 contemplating a written submission by Pakistan analysing  
 24 those documents that would be submitted to the Court at  
 25 some point in the future? Is that what you have in

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11:10 1 That will, of course, be a written submission  
 2 attaching the analysis of the logbooks. We expect that  
 3 you will authorise that, because that's implicit in the  
 4 procedure that you identified in PO19. It will then be  
 5 a question for you as to whether you have any questions  
 6 to put to us on the basis of those documents and that  
 7 analysis; and if so, whether you anticipate that those  
 8 questions would simply be addressed in writing or  
 9 whether you would like a brief video hearing.  
 10 We don't expect, candidly, that these issues are  
 11 going to be immensely complex. There are not volumes  
 12 and volumes of paper. There are some detailed  
 13 spreadsheets, there is an analysis which makes sense of  
 14 those spreadsheets and there are conclusions to be  
 15 drawn. You may have some follow-up questions to us, but  
 16 we do not think that this should delay your proceedings  
 17 in any way.  
 18 THE CHAIRMAN: So just to follow up on what might be  
 19 the steps that we're looking at: if, by next Monday,  
 20 February 9, India does not respond to the Court's order,  
 21 do I understand correctly that Pakistan at that point  
 22 will indicate to the Court what kind of order it seeks,  
 23 or perhaps even during the course of this hearing will  
 24 indicate to the Court exactly what kind of order it is  
 25 seeking, and then the Court would review that request,

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11:08 1 mind? Obviously, if so, that also affects the timing of  
 2 Court's consideration of that submission and the  
 3 issuance of the award.  
 4 SIR DANIEL: Yes, Mr Chairman, I think we do have precisely  
 5 that in contemplation, because in your PO9 you were very  
 6 clear that if the documents -- the "Neutral Expert  
 7 pondage documents", as you characterise them -- are  
 8 actually submitted into your proceedings, those will not  
 9 include Pakistan's analysis of those pondage logbooks.  
 10 So we will have to prepare, as per your directions,  
 11 a bespoke analysis.  
 12 Of course, we have our analysis on the stocks  
 13 because we've submitted to the Neutral Expert, so  
 14 we don't anticipate that this is going to require  
 15 terribly long. I think you've given India a week in  
 16 which to respond to the order that you have made. We  
 17 have communicated the identification of the documents,  
 18 as was required, by today's deadline.  
 19 Depending on when you make a decision, assuming that  
 20 India does not voluntarily simply submit those documents  
 21 into the record, assuming you make that decision very  
 22 quickly -- early/middle of next week -- we don't  
 23 anticipate that we would require more than simply a few  
 24 days -- perhaps a week, depending on absences of  
 25 people -- to submit our analysis to you.

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11:12 1 and perhaps issue an order that would result in the  
 2 documents coming into the Court; and in addition to  
 3 that, there would be a submission by Pakistan in  
 4 writing? Is that the sequence you have in mind?  
 5 SIR DANIEL: Mr Chairman, with your leave, I'm going to  
 6 reflect on this a little bit further with my colleagues,  
 7 and go back to the language of PO19.  
 8 My recollection of whatever it is -- I think it's  
 9 paragraph 52 of PO19, or paragraph 53 of PO19 -- [is  
 10 that] you left open the procedure to be followed if and  
 11 when either India does reply but contests Pakistan's  
 12 application, or is simply silent. And the issue then --  
 13 and you go on to say that "the Court [will] decide".  
 14 I'm not sure that we had it in clear contemplation  
 15 that the Court would decide on the basis of  
 16 an application that you expected Pakistan to make, or  
 17 whether you have already apprehended that Pakistan has  
 18 made an application, and you will simply then decide on  
 19 what approach is to be followed.  
 20 In my initial observation, coming to the microphone,  
 21 I requested that before you make that order, you simply  
 22 invite Pakistan to make any observations on the  
 23 documents.  
 24 And to illuminate that issue a little bit more  
 25 fully, as I've indicated, there are three documents that

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11:14 1 we've identified to India. Two of those documents fall  
 2 unequivocally within the framework of PO19, that you  
 3 have identified as being documents that were prepared  
 4 historically; they were not documents prepared for  
 5 the Neutral Expert proceedings.  
 6 There is a third document that we consider is  
 7 historic material, in the sense that it was prepared  
 8 much, much before the Neutral Expert proceedings, but  
 9 that it was submitted as an appendix to an expert report  
 10 that was introduced into the Neutral Expert proceedings.  
 11 Now, we want to be completely candid and transparent  
 12 with you in identifying the character of these documents  
 13 before you make your order. We think that the three  
 14 documents that we have identified for India fall  
 15 squarely within the four corners of your order, but we  
 16 want you to have an appreciation of precisely what those  
 17 documents are.  
 18 You may be in a position, the day after the expiry  
 19 of the deadline of your order to India -- assuming for  
 20 the moment that India does not respond -- you may be in  
 21 a position to write to us immediately and say, "Please  
 22 address what the documents are, because the Court is  
 23 going to make an order", and I expect we will be able to  
 24 do that within 24 hours, simply subject to practical  
 25 constraints.

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11:15 1 So as I stand here, we were not immediately  
 2 envisaging that we would have to come back to you to  
 3 request an order in specific terms, because we  
 4 understood your Procedural Order No. 19 to have in fact  
 5 occupied the space, apprehended Pakistan's issues, and  
 6 that you would make an order, whatever that may be:  
 7 don't admit them; admit them because you have them, and  
 8 India, as a party to these proceedings, has not; make  
 9 an application to the Neutral Expert; whatever you might  
 10 decide. But if you would like us to [request] an order,  
 11 we will absolutely [request] an order.  
 12 THE CHAIRMAN: I think what the Court intended in that  
 13 paragraph 52 of Procedural Order 19 was to indicate that  
 14 there are different possibilities here for what a next  
 15 step might be: it could be an order to Pakistan to  
 16 produce the documents; it could be an order to the  
 17 Neutral Expert to release any confidentiality  
 18 constraints that might otherwise exist; it could be  
 19 an adverse inference to be drawn, without any production  
 20 of documents; that there were different possibilities in  
 21 play, and that the Court was looking, in the course of  
 22 this hearing, for Pakistan to address such  
 23 possibilities. And if you are seeking a further order  
 24 from the Court, paragraph 52 says:  
 25 "... Pakistan ... shall specify exactly what it

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11:17 1 seeks in that regard."  
 2 So that is what we are hoping to get during the  
 3 course of this hearing, either today or tomorrow, and  
 4 perhaps you can reflect upon that.  
 5 SIR DANIEL: You will get precisely what we seek before  
 6 the close of the proceedings tomorrow.  
 7 THE CHAIRMAN: Very good.  
 8 Any other follow-up? No, okay.  
 9 So thank you, Sir Daniel, very much for those  
 10 remarks.  
 11 I believe that we are at that point in the hearing  
 12 where we probably should take a break, before we hear  
 13 from Professor Webb. So why don't we take a 15-minute  
 14 break, come back at 11.35.  
 15 SIR DANIEL: Thank you.  
 16 (11.18 am)  
 17 (A short break)  
 18 (11.36 am)  
 19 THE CHAIRMAN: Welcome back, everyone. I see that  
 20 Professor Webb is at the podium. So when you're ready,  
 21 please proceed with your presentation.  
 22 PROFESSOR WEBB: (Slide 1) Thank you, Mr Chairman, members  
 23 of the Court. It is an honour to appear before you on  
 24 behalf of Pakistan. I will be addressing the historic  
 25 practice on India's calculation for maximum pondage and

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11:36 1 relevant issues of treaty interpretation.  
 2 As Sir Daniel pointed out, these pleadings draw on  
 3 Chapter 2 and the first half of Chapter 3 of Pakistan's  
 4 Memorial on the Second Phase on the Merits, and also  
 5 respond to matters requested in the Court's Procedural  
 6 Order No. 17.  
 7 (Slide 2) Before getting into some of the detail on  
 8 the data provided by India, and discussions between the  
 9 Parties, there are five key takeaways from the written  
 10 record.  
 11 First, in providing the details of the installed  
 12 capacity of each Annexure D.3 HEP, India initially  
 13 allocated a portion of the capacity for firm power, and  
 14 the remainder for secondary power. But starting with  
 15 the Sumbal HEP in 1969, and with only a few exceptions  
 16 since then, India has provided the installed capacity in  
 17 the aggregate, without allocating power units between  
 18 firm power and secondary power.  
 19 The second point is that India has relied on  
 20 a hypothetical load curve in its calculations for  
 21 maximum pondage, rather than determining the actual  
 22 anticipated load for its HEPs. From 1984, with respect  
 23 to the Dul Hasti HEP, India attempted to justify this  
 24 approach by reference to the "Hydro-thermal mix" in its  
 25 power system and the need for "more flexibility in

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<p>11:38 1 operation in order to cater [for] varying load demands",                  2 and I will later take the Court to that specific                  3 correspondence and minutes (Exhibit P-0649.0513).                  4 Third, India's calculations for maximum permissible                  5 pondage for HEPs in the late 1960s incorporated the use                  6 of a load factor. This assumed the HEP was producing                  7 power at less than its full installed capacity,                  8 reflecting conventional hydroengineering practice. But                  9 for later projects, India's calculations assumed that                  10 the HEP would produce at its full installed capacity.                  11 Fourth, again in the earlier projects, in the late                  12 1960s, India relied on a daily loading schedule. But                  13 from 1978, with the Dul Hasti and Baglihar HEPs, India                  14 used a weekly loading schedule in order to generate much                  15 larger volumes of pondage in their designs.                  16 And finally, India initially resisted providing                  17 details of its calculations for the maximum permissible                  18 pondage, which included important information on the                  19 anticipated load. And it was only after repeated                  20 requests from Pakistan that these details were provided.                  21 India has later provided these details as a standard                  22 practice, save for where it considers the pondage to be                  23 negligible.                  24 (Slide 3) I'll now develop each of these points with                  25 illustrations from the record before the Court. First,</p> <p style="text-align: center;">Page 61</p>	<p>11:41 1 calculate the Operating Pool and would be relevant to                  2 the expected variations in the turbine discharge."                  3 (Slide 6) If we look at each provision of relevance                  4 in Appendix II of Annexure D, we focus on the three                  5 concepts relevant to this phase of proceedings:                  6 "capacity", "load" and "calculations for ... maximum                  7 Pondage".                  8 "Capacity" is in paragraph 4(i) of Appendix II and                  9 requires India to provide the "Maximum aggregate                  10 capacity of power units ... for Firm Power and Secondary                  11 Power".                  12 "Load" is in paragraph 4(h), and India is required                  13 to provide the "Discharge proposed to be passed through                  14 the Plant, initially and ultimately, and the expected                  15 variations".                  16 "Calculations for ... maximum pondage" are in                  17 paragraph 3(b), compelling India to provide the HEP's                  18 "Full Pondage Level, Dead Storage Level and Operating                  19 Pool together with the calculations for the Operating                  20 Pool".                  21 Appendix III contains virtually identical                  22 notification requirements, but does not require any                  23 information with respect to load.                  24 India has, with some omissions, provided the                  25 information required by Appendices II and III by way of</p> <p style="text-align: center;">Page 63</p>
<p>11:39 1 I will address the data on capacity load and calculation                  2 of maximum pondage; then the discussions between the                  3 Parties on those same three issues; then Pakistan's                  4 observations on India's approach to the calculation of                  5 maximum pondage; and finally, some treaty interpretation                  6 issues of direct relevance to the pondage question.                  7 Starting with the data on capacity and load.                  8 (Slide 4) Under paragraph 9 of Annexure D, India                  9 must provide data with respect to each proposed                  10 Annexure D.3 HEP, as set out in Appendix II of                  11 Annexure D. And as already noted earlier today by                  12 Sir Daniel, India must communicate to Pakistan in                  13 writing certain information at least six months "in                  14 advance of the beginning of construction of river works                  15 connected with the Plant". This is to enable Pakistan                  16 to satisfy itself that the design of the proposed plant                  17 "conforms to the [paragraph 8] criteria".                  18 (Slide 5) And as this Court found in its General                  19 Issues Award at paragraph 689, the provisions in                  20 Appendix II are:                  21 "... fully capable of being understood as requiring                  22 India, when notifying Pakistan of its intention to                  23 construct an Annexure D, Part 3 HEP, to inform Pakistan                  24 of the plant's installed capacity and anticipated load,                  25 given that such information would be necessary to</p> <p style="text-align: center;">Page 62</p>	<p>11:42 1 a letter for each new proposed Annexure D.3 HEP. And                  2 Appendix A to Pakistan's Memorial in this phase of                  3 proceedings details the data provided by India for each                  4 HEP since the entry into force of the Treaty.                  5 India has historically provided a proposed installed                  6 generating capacity for each HEP in megawatts. This                  7 figure is generally provided in the aggregate, as I've                  8 mentioned, not distinguishing between firm power and                  9 secondary power.                  10 The anticipated load is provided in cumecs, and the                  11 anticipated load variations for each HEP are included in                  12 India's calculations for the maximum pondage as                  13 a simplified load curve in table form. India has failed                  14 to include its calculations for the operating pool on                  15 multiple observations.                  16 For some larger HEPs for which no pondage is                  17 proposed, such as Salal, India tends to indicate that it                  18 does not anticipate any variations in load because that                  19 HEP will operate as a pure run-of-river plant, with                  20 constant power output, no storage or release of water                  21 that changes the natural river flow.                  22 (Slide 7) But our concern is for HEPs with pondage,                  23 and India's practice has varied over time.                  24 After the entry into force of the Treaty in the                  25 1960s, India calculated the operating pool on the basis</p> <p style="text-align: center;">Page 64</p>

11:44 1 of daily load variations. But with India's notification  
 2 of the Dul Hasti HEP in July 1978, India proposed  
 3 an 8 million metre cubed operating pool on the basis of  
 4 a weekly load variation. India then reverted to daily  
 5 load calculations in a six-year period between 1984 and  
 6 1990, but then with Baglihar it returned to a weekly  
 7 load variation, and that practice has continued since  
 8 then for all large HEPs notified by India.  
 9 (Slide 8) India's calculation of the maximum  
 10 permissible pondage is included in the operating pool  
 11 calculations that I've just referred to. But while  
 12 India provides the volume of its actual proposed  
 13 operating pool, which is its proposed actual pondage, it  
 14 often fails to provide detailed calculations for its  
 15 claimed pondage entitlement; that is, the maximum  
 16 permissible operating pool India claims it would be  
 17 permitted to construct within the limits imposed by the  
 18 Treaty.  
 19 Pakistan has repeatedly requested the correct  
 20 information, and in some cases India has later provided  
 21 the calculations, and this is set out in Appendix B to  
 22 our Memorial.  
 23 (Slide 9) So I now turn from data to discussions  
 24 between the Parties. And in Appendix B, Pakistan sets  
 25 out relevant communications between the Parties on

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11:46 1 pondage. These are letters between the Parties'  
 2 Commissioners for Indus Waters, these are the records of  
 3 the meetings of the Permanent Indus Commission and also  
 4 the minutes of Secretary-level discussions, often on  
 5 specific plants.  
 6 (Slide 10) The Parties' discussions on capacity can  
 7 be illustrated by the exchanges on the Stakna HEP, which  
 8 was notified to Pakistan in September 1968. So this is  
 9 early in the life of the Treaty, and you can tell from  
 10 the quality of the correspondence that we've scanned.  
 11 So India proposed a small installed capacity of  
 12 six units of 540 kW each, with four to five units  
 13 reserved for firm power and one to two units for  
 14 secondary power.  
 15 Pakistan's Commissioner -- and that's the letter on  
 16 the left of your screen (Exhibit P-0649.0137) -- asked  
 17 India for the "exact value of Firm Power". But India's  
 18 Commissioner -- and that's the correspondence on the  
 19 right of your screen (Exhibit P-0649.0163) -- said that  
 20 the "concrete figures for Firm and Secondary Power are  
 21 not required to be supplied under [the Treaty]".  
 22 Nevertheless, he did indicate that there was 2,450 kW of  
 23 the HEP's capacity for firm power and 790 kW for  
 24 secondary power.  
 25 India kept providing installed capacity in the

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11:47 1 aggregate for HEPs that followed, and Pakistan did  
 2 gradually drop its protests over time.  
 3 (Slide 11) But Pakistan did continue to consider  
 4 that this breakdown in capacity between firm power and  
 5 secondary power was important. And in 1993, in relation  
 6 to the Thiroth HEP (Exhibit P-0649.0787), Pakistan's  
 7 Commissioner explained that:  
 8 "In [India's] statement of calculations for [the]  
 9 Operating Pool ... Pondage has been calculated as  
 10 Pondage required for the maximum aggregate capacity of  
 11 power units for Firm Power and Secondary Power.  
 12 It should be limited to the extent required for Firm  
 13 Power only, as per [the] scheme of things incorporated  
 14 in the Treaty."  
 15 Yes.  
 16 THE CHAIRMAN: Professor Webb, this may be for later counsel  
 17 or experts to address, and if so, feel free to put off  
 18 the answer to the question. But based on what you just  
 19 said and based on what's in the Memorial, it does appear  
 20 to be case that Pakistan largely stopped objecting to  
 21 the failure to provide calculations or data relating to  
 22 firm power or secondary power.  
 23 So my basic question is: does Pakistan today still  
 24 regard the notification requirements in the Treaty as  
 25 requiring a breakdown between firm power and secondary

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11:49 1 power; and if so, what exactly is the practical  
 2 relevance of receiving that data?  
 3 PROFESSOR WEBB: Yes, I'll just give a broad response to  
 4 that now, Mr Chairman, and we'll come back to you in our  
 5 later speakers and tomorrow.  
 6 This goes back to Sir Daniel Bethlehem's point and  
 7 also your exchange with him earlier today, which is that  
 8 each of these decisions by India to aggregate, to say  
 9 that things cannot be calculated, to say that they must  
 10 design HEPs in a way that can cater for any future  
 11 eventuality, all increase the uncertainty in this  
 12 process of design and operation, and this is part of  
 13 that.  
 14 But we'll come back to you specifically on the  
 15 practical relevance in Pakistan's submission. As of  
 16 1993, we were still objecting to this practice.  
 17 PROFESSOR MINEAR: Since we've stopped you, Professor, could  
 18 I ask: do you know when India began adding HEPs to the  
 19 regional grid? It seems to me that might have some  
 20 bearing on the information that India was providing.  
 21 PROFESSOR WEBB: Yes. Yes. It was from the 1960s  
 22 the Northern Regional Grid was being built up, and it  
 23 was a very long process. With some exceptions to it --  
 24 there are some plants in Jammu and Kashmir, for example,  
 25 that were not added for a very long time -- but the

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11:50 1 actual connecting of the Northern Regional Grid to the  
 2 national grid happened in August 2006. But this is  
 3 a process since the 1960s.  
 4 PROFESSOR MINEAR: I see. But some of these early HEPs,  
 5 such as Stakna, were they on a local grid rather than  
 6 the regional grid at the time that they were planned and  
 7 constructed?  
 8 PROFESSOR WEBB: I would have to come back to you and check  
 9 on those specific ones.  
 10 PROFESSOR MINEAR: Thank you.  
 11 PROFESSOR WEBB: Because it was an iterative process.  
 12 PROFESSOR MINEAR: Thank you, Professor.  
 13 PROFESSOR WEBB: I'll come back later on some correspondence  
 14 about the grids in relation to certain HEPs as well.  
 15 (Slide 12) So when it came to discussions of load,  
 16 India relied on a hypothetical load curve to map  
 17 anticipated load fluctuations, while Pakistan contended  
 18 that an actual load curve should be used.  
 19 You can see here the point being made by Pakistan in  
 20 relation to the Sumbal HEP -- again, this is relatively  
 21 soon after entry into force of the Treaty -- but this  
 22 was a point that Pakistan made in relation to many HEPs  
 23 over the decades, and they are detailed in our Memorial.  
 24 And I could just say that it's also in relation to the  
 25 Lower Jhelum HEP, the Chinani-I HEP, Dul Hasti, the

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11:53 1 said (Exhibit P-0649.0833):  
 2 "... the load curve supplied for the calculation of  
 3 pondage was a hypothetical one and has not been based on  
 4 the actual operation of the Plant which would be  
 5 grid[d]ed nation wide."  
 6 In response to Mr Minear's question, the "grid[ding]  
 7 nation wide" didn't happen until the 2000s.  
 8 So let's look briefly at the exchanges regarding the  
 9 Kishenganga and the Ratle HEPs.  
 10 (Slide 14) In 2006, Pakistan said (Exhibit P-0056)  
 11 that India was calculating pondage "with reference to  
 12 an arbitrarily determined set of peaking requirements"  
 13 that did not include any peaking during the weekends.  
 14 India said in response (Exhibit P-0057) that this was  
 15 "[d]ue to [a] relatively lower demand on Saturday [and]  
 16 Sunday", and that carrying forward the weekend storage  
 17 to the working days of the week was "permissible in view  
 18 of the very definition of 'Pondage' in Paragraph 2(c)"  
 19 as well as the daily inflow and outflow requirements of  
 20 paragraph 15.  
 21 Pakistan came back (Exhibit P-0059) saying this is  
 22 an "arbitrary peaking schedule" that bears "no  
 23 resemblance to the peak load [that] would actually be  
 24 expected on a reasonable or objective basis".  
 25 (Slide 15) And seven years later, in relation to the

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11:52 1 Asthan Nallah HEP, the Parnai HEP, Rajouri HEP,  
 2 Sumoor Nobra HEP, Baglihar and Ratle.  
 3 So as you can see, this statement  
 4 (Exhibit P-0649.0143) is that:  
 5 "The Live Storage needed for meeting the water  
 6 requirements of a Plant during the period of minimum  
 7 mean discharge would naturally depend on the load curve.  
 8 To see that the maximum Pondage being provided did not  
 9 exceed twice the Pondage required for Firm Power, the  
 10 magnitude of the Live Storage has to be determined from  
 11 [an] actual load curve worked out for the proposed Plant  
 12 and not from any hypothetical load curve."  
 13 India, in response, disagreed, saying its  
 14 calculations were necessary to accommodate peaking.  
 15 (Slide 13) So another example, which was in 1984,  
 16 was in relation to the Dul Hasti HEP, which has very  
 17 large proposed pondage. And India said  
 18 (Exhibit P-0649.0513):  
 19 "These calculations are not hypothetical. [The]  
 20 plant would be required to operate in the grid and has  
 21 to provide necessary peaking capacity under the varying  
 22 conditions of Hydro-thermal mix and system operating  
 23 conditions at different points of time."  
 24 On the right-hand side, you see the response of  
 25 Pakistan's Commissioner, who rejected this view, and

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11:54 1 Ratle HEP. India made the similar argument  
 2 (Exhibit P-0082) that:  
 3 "... there can be no objection to the Plant  
 4 generating power in any pattern, including peaking, so  
 5 long as it releases water in accordance with  
 6 Paragraph 15."  
 7 Pakistan maintained that India was manipulating load  
 8 variations in a hypothetical manner to maximise pondage,  
 9 including pointing out that paragraph 15 is  
 10 an operational criterion that should not be used to  
 11 determine the plant's design.  
 12 Turning to the calculation of maximum pondage --  
 13 yes.  
 14 THE CHAIRMAN: Sorry, Professor Webb, before you move on.  
 15 I thought in your Memorial and just now, you did  
 16 a good job of indicating to us that repeatedly, when you  
 17 look at the historical record, Pakistan faulted India  
 18 for providing a hypothetical load curve rather than  
 19 an actual load curve.  
 20 PROFESSOR WEBB: Yes.  
 21 THE CHAIRMAN: What was less clear to me in my own review of  
 22 the historical record, and certainly in looking at your  
 23 Memorial, was what factors led Pakistan to conclude that  
 24 the load curve was hypothetical. In other words,  
 25 Pakistan must have had in mind something. You just

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11:56 1 referred to: it needs to be reasonable, it needs to be  
 2 objective. But it wasn't clear to me what were the  
 3 touchstones for Pakistan in concluding that something  
 4 was unreasonable or not objective.  
 5 PROFESSOR WEBB: Yes.  
 6 THE CHAIRMAN: So either now or in due course, I would find  
 7 it helpful to gather up, if you will, from the  
 8 historical record, what were the factors that led  
 9 Pakistan, on those various occasions, to determine that  
 10 this load curve was hypothetical, as it's not obvious to  
 11 me how that conclusion was reached.  
 12 PROFESSOR WEBB: Yes. Thank you, Mr Chairman, that's a very  
 13 good steer. This will be addressed by Dr Miles and  
 14 Mr Rae from legal and engineering perspectives. I am  
 15 also going to be taking you to some correspondence  
 16 a little later in my presentation where this is  
 17 developed further. But the idea of gathering up the  
 18 record is one that we will take up and come back to.  
 19 THE CHAIRMAN: And if I can, the same sort of query might be  
 20 made with respect to installed capacity.  
 21 PROFESSOR WEBB: Yes.  
 22 THE CHAIRMAN: My impression from the historical record is  
 23 that there were perhaps somewhat less objections from  
 24 Pakistan in that regard, but nevertheless, in some  
 25 situations, objections were lodged. And again, it

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11:59 1 paragraph 2(c), and what it said was the "purpose" of  
 2 pondage: to meet fluctuations in the discharge of the  
 3 turbines arising from variations in the daily and weekly  
 4 loads of the plant (Exhibit P-0659.1364).  
 5 (Slide 17) Pakistan notes the Court's request in  
 6 Procedural Order No. 17 to address the basis upon which  
 7 Pakistan understands India to have determined the  
 8 installed capacity and anticipated loads for HEPs up to  
 9 and including Baglihar, including (paragraph 2.3.4(a))  
 10 "how [these] elements were [to be] taken into account in  
 11 [India's] calculation of maximum Pondage", as well as  
 12 "concerns expressed by Pakistan" with respect to those  
 13 issues.  
 14 So according to what the Court has specified in this  
 15 paragraph of the procedural order, this covers the  
 16 period 1968 to 1992. (Pause)  
 17 This covers the period 1968 to 1992. And this was  
 18 a period when there were 32 Annexure D.3 HEPs notified  
 19 by India, but 19 of these did not incorporate pondage in  
 20 their designs, or had negligible pondage. So we are  
 21 really concerned with 13 Annexure D.3. HEPs. They are  
 22 Stakna, Sumbal, Lower Jhelum, Chinani-I, Dul Hasti,  
 23 Upper Sind-II, Kargil, Thiroat, Asthan Nallah, Bhadarwah,  
 24 Parnai, Rajouri and Baglihar.  
 25 But I do note that India's approach to determining

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11:57 1 wasn't entirely clear to me what were the factors at  
 2 issue that Pakistan had in its possession.  
 3 And one might link both of these to the information  
 4 either Pakistan had already, without receiving anything  
 5 from India, or information that it felt it should be  
 6 receiving from India that would clarify whether the  
 7 installed capacity or the load were proper.  
 8 PROFESSOR WEBB: Yes, indeed. Thank you, Mr Chairman.  
 9 (Slide 16) So turning now to the calculation of  
 10 maximum pondage, Pakistan protested India's use of plant  
 11 loading and installed capacity as the basis for its  
 12 pondage calculation, rather than firm power that can  
 13 actually be generated at a time when the river is  
 14 carrying the MMD. And this is a representative sample,  
 15 and goes partly to your question, Mr Chairman, from the  
 16 Lower Jhelum HEP.  
 17 In particular, Pakistan notes (Exhibit P-0649.0342)  
 18 that:  
 19 "It may please be appreciated [by India] that the  
 20 capacity of the Operating Pool is to correspond to the  
 21 Firm Power which can be actually generated at a time  
 22 when the river is carrying the [MMD]."  
 23 Noting that the information provided by India did  
 24 "not depict the actual variations through the turbines".  
 25 India, in turn, justified its approach by invoking

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12:01 1 anticipated load, and how that's taken into account in  
 2 its calculation of maximum pondage, has generally stayed  
 3 the same since the Baglihar HEP was notified. So  
 4 correspondence and minutes on post-Baglihar HEPs are  
 5 also relevant to the question asked by the Court.  
 6 So turning first to installed capacity.  
 7 (Slide 18) The basis upon which India determines the  
 8 installed capacity of a proposed HEP has not been  
 9 the subject -- as you observed, Mr Chairman -- of  
 10 significant disagreement between the Parties in the  
 11 relevant period.  
 12 India's approach, as expressed in a meeting of the  
 13 Permanent Indus Commission in 2013 in relation to Miyar  
 14 HEP (Exhibit P-0083), was stated as follows. India's  
 15 view was that:  
 16 "... hydro projects in India are generally being  
 17 planned based on 90% dependable year flow data. The  
 18 installed capacity of these projects is finalized after  
 19 carrying out incremental benefit analysis and the  
 20 optimization studies. Various other factors like  
 21 exploitation of overall potential available at the site  
 22 are also considered for finalization of installed  
 23 capacity."  
 24 Dr Miles will later set out Pakistan's understanding  
 25 of the reasonable basis on which India must determine

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12:02 1 the installed capacity for its Western River HEPs.  
 2 As I have already addressed, the Parties also  
 3 discussed which portion of the maximum aggregate  
 4 capacity was allocated for firm power and secondary  
 5 power; a distinction that India did not make, except in  
 6 its earliest designs.  
 7 As for how installed capacity is taken into account  
 8 in India's calculation of maximum pondage, in the late  
 9 1960s, India included a load factor as part of the  
 10 information on the maximum aggregate capacity of the  
 11 HEP's power units. This meant that the hours the plant  
 12 was producing power its turbines were running at less  
 13 than their full installed capacity. Pakistan considers  
 14 this to be a reasonable and expected approach to  
 15 dry-season turbine operation in a hydroengineering  
 16 context.  
 17 But that was in those few plants in the late 1960s.  
 18 As I flagged earlier, India changed its approach for  
 19 later HEPs, including Baglihar and post-Baglihar HEPs,  
 20 and its pondage calculations had periods where the plant  
 21 was operating at full installed capacity and other  
 22 periods where the plant was zero-loaded. And this again  
 23 goes back to your question, Mr Chairman, about the  
 24 various bases and factors for Pakistan's concerns.  
 25 (Slide 19) The disagreement between the Parties can

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12:04 1 be illustrated by the minutes of the Secretary-level  
 2 meetings on the Baglihar HEP that took place in 2005  
 3 (Exhibit P-0650.1).  
 4 India's position was that firm power for the  
 5 calculation of maximum pondage was 130 MW for the  
 6 Baglihar HEP, which had an installed capacity of 450 MW,  
 7 noting a "distinction between the [Firm] [P]ower and the  
 8 generating [installed] capacity of the plant".  
 9 Pakistan said that India's calculations for maximum  
 10 pondage were not actually based on firm power, but for  
 11 the full installed capacity of 450 MW "to meet ...  
 12 peaking requirement[s]".  
 13 You can see Pakistan's position that:  
 14 "It was accepted by India that based on the minimum  
 15 mean discharge of 125.89 cumecs and the project designed  
 16 by them, the Firm Power is 130 MW. However ..."  
 17 And this is highlighted on the screen:  
 18 "... they ..."  
 19 Meaning India:  
 20 "... have designed the plant for 450 MW to meet  
 21 the peaking requirement."  
 22 It goes on to say:  
 23 "The daily and weekly fluctuations cannot be  
 24 construed to be 3.5 times of the Firm Power. As such  
 25 450 MW capacity being operated intermittently, cannot be

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12:05 1 taken as Firm Power for calculation of Pondage."  
 2 (Slide 20) The Parties' historic disagreement over  
 3 India's pondage methodology also concerns the  
 4 determination of anticipated load and how it's accounted  
 5 for in the pondage calculation.  
 6 Pakistan has consistently maintained that India  
 7 presents a hypothetical load curve -- yes, Mr Chairman.  
 8 THE CHAIRMAN: Just because I think you're moving on from  
 9 your Baglihar slide --  
 10 PROFESSOR WEBB: Yes.  
 11 THE CHAIRMAN: -- I wanted to ask you this question, again  
 12 for response now or in due course.  
 13 Do I recall correctly that in the Baglihar  
 14 proceedings, Pakistan objected to the concept of  
 15 operating an Annexure D, Part 3 HEP as a peaking plant?  
 16 In your Memorial on this phase at paragraph 2.64, you  
 17 seem to confirm that that was Pakistan's position. I'm  
 18 just wondering: is that a correct characterisation of  
 19 what Pakistan was saying in the Baglihar proceeding?  
 20 And then is that now also Pakistan's position, or do  
 21 you now take the view that in principle it is possible  
 22 to use pondage for an Annexure D, Part 3 HEP as  
 23 a peaking plant, subject to, of course, the various  
 24 constraints that you've advanced in the Memorial?  
 25 PROFESSOR WEBB: Yes, thank you, Mr Chairman.

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12:07 1 I believe we're going to be addressing this today in  
 2 our further presentations, but just to be absolutely  
 3 sure on the two parts of your question, I'm going to  
 4 consult with my colleagues before we come back to you.  
 5 We have the benefit of having members of our team who  
 6 were actually in those proceedings, and not just the  
 7 full record of the proceedings. So we'll be able to  
 8 verify that today.  
 9 (Slide 20) So going back to the anticipated load.  
 10 Pakistan has consistently maintained that India  
 11 presents a "hypothetical load curve" that is not  
 12 "realistic" and not "based on the actual operation of  
 13 the Plant", and this position has been communicated  
 14 since the late 1960s.  
 15 If we look at their exchanges on the Dul Hasti HEP  
 16 (Exhibit P-0649.0493), which had the largest volume of  
 17 pondage in India's designs at the time, Pakistan's  
 18 Commissioner objected to India's calculations in clear  
 19 terms, saying that the calculations given under  
 20 Appendix II were "hypothetical":  
 21 "As such [they should] be revised and calculations  
 22 of [the] actual operation of the Plant be supplied so  
 23 that Pakistan can know the actual variations in the  
 24 supplies."  
 25 India's Commissioner denied that the calculations

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<p>12:08 1 provided were hypothetical and asserted 2 (Exhibit P-0649.0513) that: 3 "This plant would be required to be operat[ing] in 4 the grid and has to provide necessary peaking capacity 5 under the varying conditions of [the] Hydro-thermal mix 6 and system operating conditions at different points [in] 7 time." 8 This is a formula that we will see again and again 9 in the correspondence. 10 In Pakistan's view, this amounted to relying on 11 a hypothetical load curve because India was assuming 12 that Dul Hasti would be providing power under varying 13 system operating conditions at different points in time. 14 In other words, India was designing its HEPs for any 15 future eventuality, no matter how unlikely, that would 16 arise in the power system, rather than the situation as 17 it actually existed or was reasonably projected to exist 18 at the time of the HEP's design. 19 (Slide 21) The disagreement over the load curve for 20 Dul Hasti was renewed in 1992 to 1993, when India 21 notified Pakistan of changes in the design of the plant. 22 Pakistan's commissioner reiterated his objection and 23 requested a "realistic load curve" to support India's 24 maximum pondage calculation (Exhibit P-0649.0773), 25 noting that:</p> <p style="text-align: center;">Page 81</p>	<p>12:11 1 Pakistan was deeply concerned that India was seeking 2 to apply the design criteria in paragraph 8 of 3 Annexure D to hypothesise an inflated amount of maximum 4 pondage by refusing to determine the actual anticipated 5 load expected for its HEPs. And you see the 6 correspondence from Pakistan's Commissioner on the right 7 of the screen (Exhibit P-0649.0822), saying that this 8 statement about the hydrothermal mix and the 9 unpredictable pattern: 10 "... is irrelevant in the context of [the] design 11 criteria laid out in Paragraph 8 of Annexure D to the 12 Treaty." 13 And he reaffirmed that: 14 "... the load demand curve supplied is hypothetical 15 ... [and] has been drawn only to achieve ... maximum 16 pondage." 17 (Slide 23) This issue was significant enough to be 18 brought to Secretary-level talks on the Baglihar HEP in 19 2005 (Exhibit P-0650.1). A member of the Indian Central 20 Water Commission explained, again using the hydrothermal 21 mix, that: 22 "... the load demand on the plant may have 23 [a] pattern consistent with system needs and generation 24 potential at the plant." 25 And it had been:</p> <p style="text-align: center;">Page 83</p>
<p>12:10 1 "It was requested to be supplied along with 2 a realistic load curve, as the load curve supplied 3 earlier was a hypothetical one and provided for a Firm 4 Power, which did not correspond to the Minimum Mean 5 Discharge." 6 In response, India's Commissioner argued that the 7 HEP was to provide "necessary peaking capacity" under, 8 again, these varying "system operating conditions at 9 different points in time" (Exhibit 1994). And again, we 10 had the response from Pakistan's Commissioner that this 11 continued to be "hypothetical" and "not based on the 12 actual operation of the Plant" (Exhibit P-0649.0833). 13 (Slide 22) We see this again in the exchanges over 14 the Baglihar HEP, where Pakistan's Commissioner objected 15 to the pondage calculation being based on a "very 16 hypothetical load curve" (Exhibit P-0649-2047). 17 According to the Indian Commissioner, the "load 18 demand curve ... can not be predicted" 19 (Exhibit P-0649.0814). He said: 20 "In a grid of [the] hydro-thermal mix, the load 21 demand curve may assume any pattern which cannot be 22 predicted ..." 23 And this recalls what the Attorney General stated at 24 the opening of these proceedings: this is where 25 flexibility leads directly to uncertainty.</p> <p style="text-align: center;">Page 82</p>	<p>12:12 1 "... designed to cater to the peaking requirements 2 of the power system during the lean flow period which 3 occur in the morning and evening hours." 4 From Pakistan's point of view, this statement is 5 helpful at least in recognising that the anticipated 6 load of the HEP must be "consistent with [the] system 7 needs". But India then goes on to add the qualifier 8 that it must also correspond to the "generation 9 potential at the plant", without providing the evidence 10 of the actual load demands of the relevant power system. 11 (Slide 24) During the same meeting 12 (Exhibit P-0650.1), Pakistan noted that the "load curve 13 provided by India provides 450 MW generation of 14 electricity for a few hours in a day and provides 15 periods of zero generation in the remaining part of the 16 day", and that this did not "correspond to the concept 17 of Firm Power and fluctuations in the continuous flow of 18 [p]ower over it", and asked again for a realistic load 19 curve. 20 (Slide 25) These issues have not disappeared in 21 the post-Baglihar period, and they continue to divide 22 the Parties. 23 THE CHAIRMAN: Professor Webb -- 24 PROFESSOR WEBB: Yes. 25 THE CHAIRMAN: -- sorry to jump in again, but just again on</p> <p style="text-align: center;">Page 84</p>

12:13 1 the historical record, before you move on from Baglihar.  
 2 I'm wondering about the factors that the Baglihar  
 3 Neutral Expert might have had in his mind when he  
 4 adjusted the pondage level that originally was proposed  
 5 by India, and that the Neutral Expert found to be  
 6 excessive and therefore should be reduced.  
 7 I think the Court is fully capable of reading the  
 8 Neutral Expert's determination to try to see what he  
 9 in fact said about that. But would be of interest if  
 10 the historical record, whether that's the written  
 11 pleadings by the Parties before the Baglihar Neutral  
 12 Expert or the factual information, some of which you've  
 13 put up on the screen here, whether it helps inform one's  
 14 understanding of the factors that the Baglihar Neutral  
 15 Expert was using in determining that the pondage should  
 16 be reduced.  
 17 Again, if you have reflections now, that's welcome;  
 18 if you wish to perhaps put this off and address it at  
 19 a later stage, that's fine as well.  
 20 PROFESSOR WEBB: Thank you, Mr Chairman. I think, given  
 21 that we would want to be accurate on the historical  
 22 record -- and as you say, that would be not just  
 23 correspondence and meeting minutes but also potentially  
 24 the pleadings in that proceeding -- that we'll come back  
 25 to you on that. But it's well noted.

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12:16 1 And in India's view:  
 2 "... [it] is free to design the Pondage of its Plant  
 3 within that limitation[] taking care of possible future  
 4 scenarios."  
 5 I now turn briefly to how anticipated load is taken  
 6 into account in India's calculation of maximum pondage.  
 7 As I mentioned in my outline, India switched between  
 8 daily and weekly loads in its calculations. For most  
 9 HEPs, including those with the largest volumes of  
 10 pondage, such as Dul Hasti and Baglihar, India relied on  
 11 a weekly load to calculate maximum pondage, and this  
 12 choice of using either daily or weekly is crucial to the  
 13 ultimate value of the claimed pondage entitlement, and  
 14 this point will be further developed by Dr Miles.  
 15 (Slide 26) But, Mr Chairman, if I may, I will now  
 16 turn to the second part of my submissions, which respond  
 17 to the Court's request that Pakistan address the meaning  
 18 of the terms "capacity", "load" and others, as used in  
 19 the Treaty.  
 20 So we have conducted a review of the travaux  
 21 préparatoires of the Treaty with respect to these terms,  
 22 and we also looked at the evolution of the drafts of the  
 23 Treaty for the provisions that the Court identified in  
 24 its General Issues Award, as "relevant context" for  
 25 interpreting paragraph 8(c). And this is set out at

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12:15 1 (Slide 25) So as I said, even in the post-Baglihar  
 2 period, these issues have continued to divide the  
 3 Parties. And if you look at the minutes of the 2017  
 4 Permanent Indus Commission meeting (Exhibit P-0103),  
 5 you can see Pakistan's position that:  
 6 "... India's Pondage computation ... was so much  
 7 oriented towards maximizing pondage that even the load  
 8 curve was not followed in a true sense. No hydropower  
 9 was generated for hours ..."  
 10 That's the zero loading:  
 11 "... to maximise the difference between [the]  
 12 cumulative inflow and outflow then [the] plant was  
 13 operated at peak capacity for many hours to fulfil the  
 14 criteria of Paragraph 15, and the real load curve of the  
 15 area [that is the] Northern Grid, was compromised."  
 16 India's Commissioner responded, and their response  
 17 in the meeting minutes is recorded on the right-hand  
 18 side (P-0103), and it confirmed Pakistan's  
 19 understanding, which is that, in India's view:  
 20 "... there [was] nothing in the Treaty which says  
 21 that load variations have to be stable throughout the  
 22 life of the Plant and the concept of [the] load curve,  
 23 too, is not explicitly provided in the Treaty. The  
 24 Treaty, however, does fix [limitations] ... through  
 25 Paragraph 15 ..."

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12:18 1 Appendix C to our Second Phase Memorial.  
 2 The travaux, as in many cases, provide only limited  
 3 guidance on the meaning of "capacity" and "load" as they  
 4 are used in the Treaty. On balance, it supports the  
 5 Court's finding in the General Issues Award that the  
 6 projection of an Annexure D.3 HEP's installed capacity  
 7 and anticipated load must be realistic, well-founded and  
 8 defensible, and not hypothetical. But beyond that, the  
 9 travaux don't really provide further guidance on how  
 10 realistic, well-founded and defensible projections  
 11 should be calculated.  
 12 So I'll make four points about treaty interpretation  
 13 issues: firstly, the definition of express terms in the  
 14 Treaty, relevant to the calculation of pondage; second,  
 15 the interpretation of relevant terms in hydropower  
 16 engineering; third, the interpretation of relevant  
 17 concepts in hydropower engineering; and then just  
 18 flagging, as the Court is more than aware, the relevant  
 19 paragraphs and findings in its General Issues Award to  
 20 illuminate these questions.  
 21 So turning first to express terms.  
 22 (Slide 27) Paragraph 8(c) refers to "[t]he maximum  
 23 Pondage in the Operating Pool", and it is "not [to]  
 24 exceed twice the Pondage required for Firm Power".  
 25 These are express terms that are defined in the

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12:19 1 Treaty. So "Pondage" is defined in paragraph 2(c);  
 2 "Operating Pool", expressly defined in paragraph 2(f);  
 3 and "Firm Power" in paragraph 2(i). And in each of  
 4 those definitions of "Pondage", "Operating Pool" and  
 5 "Firm Power", other terms are used that are themselves  
 6 expressly defined in the Treaty. And those terms are  
 7 "Dead Storage", "Dead Storage Level", "Live Storage" and  
 8 "Full Pondage Level". The Court is very familiar with  
 9 them, but just to flag that they appear defined at  
 10 paragraphs 2(a), (b) and (d).  
 11 (Slide 28) But Annexure D contains other engineering  
 12 terms that may be relevant to the calculation of pondage  
 13 but are not expressly defined in the Treaty. And as the  
 14 Court noted in its General Issues Award  
 15 (paragraphs 270-272), the Treaty:  
 16 "... shall be interpreted 'in good faith' in  
 17 accordance with the 'ordinary meaning' to be given to  
 18 the terms of the treaty in their 'context' and in the  
 19 light of the ... 'object and purpose'."  
 20 So in order to discern the ordinary meaning of these  
 21 engineering terms, Pakistan has consulted the glossaries  
 22 of the Hydropower Manual of the US Army Corps of  
 23 Engineers (Exhibit P-0302), and Gulliver and Arndt's  
 24 Hydropower Engineering Handbook (Exhibit P-0477).  
 25 So looking at the relevant definitions here -- and

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12:22 1 "The load for which a generator, turbine,  
 2 transformer, transmission circuit, apparatus, station or  
 3 system is rated."  
 4 But it can also be the discharge or "hydraulic"  
 5 capacity of a plant, being "The maximum flow which  
 6 a hydroelectric plant can utilize for energy"; also from  
 7 the Army Corps of Engineers.  
 8 The "maximum aggregate capacity", within the context  
 9 of paragraph 4(i) of the Treaty, means that "capacity"  
 10 is likely referring to "installed" capacity, being, as  
 11 defined again by the US Army Corps's Manual:  
 12 "The sum of capacities in a powerplant or power  
 13 system, as shown by the nameplate ratings of similar  
 14 kinds of apparatus, such as generating units, turbines,  
 15 or other equipment."  
 16 So it is the capacity of the plant that is relevant.  
 17 (Slide 30) Paragraph 4(i) also refers to "power  
 18 unit[s]". These can be assimilated to "generating  
 19 unit[s]", which are defined as a "single power-producing  
 20 unit, comprised of a turbine, generator, and related  
 21 equipment".  
 22 "Firm Power", as we know, has been defined in  
 23 paragraph 2(i) of Annexure D of the Treaty. But that  
 24 definition is in fact the Treaty's method of calculating  
 25 firm power. It is a special meaning given to "Firm

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12:21 1 remember, this is just the start of the interpretative  
 2 process, starting with the ordinary meaning under the  
 3 Vienna Convention principles -- when defining "daily and  
 4 weekly loads of the plant", as appears in paragraph 2(c)  
 5 of the Treaty, "load" is "the amount of electric power  
 6 delivered at a given point" by the plant within the  
 7 power system to which it is attached. So it corresponds  
 8 to the demand that power system places on the plant on  
 9 either a daily or weekly basis.  
 10 A "plant" is of course a "comprehensive term for all  
 11 structures ... necessary for utilizing a selected power  
 12 site".  
 13 And "power", in paragraph 2(i), is "[t]he time rate  
 14 of transferring energy, "energy" being "[t]hat which  
 15 does or is capable of doing work". Electricity is  
 16 obviously a form of energy, measured in megawatt-hours.  
 17 And electrical power is the rate at which energy is  
 18 generated and transferred to the power system, as  
 19 measured in megawatts.  
 20 (Slide 29) "Capacity" appears in paragraph 4(i) of  
 21 Appendix II to Annexure D, in the context of the maximum  
 22 aggregate capacity of power units for firm power and  
 23 secondary power. "Capacity" may have several meanings.  
 24 The generic meaning, as appears in the US Army Corps of  
 25 Engineers' Manual (Exhibit P-0302), is:

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12:24 1 Power" under the principles of the Vienna Convention.  
 2 But in order to understand the ordinary meaning, we have  
 3 the extracts from the US Army Corp of Engineers,  
 4 defining it as the:  
 5 "Power intended to have assured availability to the  
 6 customer ... to meet all or any agreed upon portion of  
 7 [his load] requirements."  
 8 And "firm energy" is the counterpart, in that it's  
 9 the:  
 10 "Electric energy which is intended to have assured  
 11 availability to the customer to meet any or all portion  
 12 of his load requirements."  
 13 "Assured availability", in this context, means that  
 14 firm energy and firm power are available at least 95% to  
 15 98% of the time; and anything in excess of that is  
 16 secondary energy.  
 17 (Slide 31) Moving now to engineering concepts, which  
 18 are more complex perhaps than the terms, there are three  
 19 concepts worth considering in the Court's interpretative  
 20 task.  
 21 We have a "load curve", the ordinary meaning of  
 22 which is:  
 23 "... [a] curve of demand versus time showing in  
 24 chronological sequence the magnitude of the load for  
 25 each unit of time of the period covered."

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12:25 1 While a load curve is ordinarily used to show the  
 2 load on the power system, it can also be adapted to show  
 3 the load on a particular plant, as demanded by the power  
 4 system, which is the sense in which the Court generally  
 5 uses the term in the General Issues Award.  
 6 "Installed capacity" is another term for what the  
 7 Treaty refers to in paragraph 4(i) of Appendix II to  
 8 Annexure D as the "maximum aggregate capacity".  
 9 Interestingly, "anticipated load" does not feature  
 10 in the glossaries of any of the hydropower manuals we  
 11 consulted. But the Court's meaning is clear when the  
 12 meaning of "load" is considered in the context of  
 13 paragraph 2(c) and the definition of pondage for the  
 14 purposes of the Treaty. It is the amount of load that  
 15 can be expected to be placed on the plant by the power  
 16 system over daily and weekly time periods.  
 17 (Slide 32) And I pause here to make a temporal  
 18 observation.  
 19 Yes, I'm still on the same point, Mr Chairman, but  
 20 I welcome your question.  
 21 THE CHAIRMAN: Why don't you continue, and then when it's  
 22 appropriate to break, you let me know and I'll ask my  
 23 question.  
 24 PROFESSOR WEBB: No, no, please.  
 25 THE CHAIRMAN: Just on that prior slide (31), as it looked

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12:28 1 run-of-river HEPs in an integrated power system. As the  
 2 Court has held (General Issues Award, paragraph 743):  
 3 "As a general matter, the plant's installed capacity  
 4 and anticipated load must correspond to how the plant  
 5 will actually be operated; it cannot be hypothesized in  
 6 a manner ... to inflate the amount of maximum Pondage."  
 7 By linking "anticipated load" to the Northern Region  
 8 Grid as it is today, Pakistan's submission is that this  
 9 is also consistent with the Court's observation in  
 10 paragraph 498 of the General Issues Award, which appears  
 11 at the beginning of a section entitled "Engineering  
 12 Concepts and Terminology Relevant to Run-of-River  
 13 Hydro-Electric Plants in Relation to Annexure D, Part 3  
 14 HEPs". The Court stated there that:  
 15 "... to the extent that Annexure D, Part 3 leaves  
 16 unstated certain fundamental concepts pertinent to the  
 17 operation of any run-of-river HEP, or uses undefined  
 18 terms ..."  
 19 And it gives an example of "loads" as an undefined  
 20 term. The Court says:  
 21 "... the ordinary understanding of such concepts and  
 22 meaning of such terms must be considered as they are  
 23 typically used for the design and operation of  
 24 run-of-river HEPs, and especially as they were used at  
 25 the time the Treaty was adopted."

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12:26 1 like you were perhaps moving on.  
 2 You've done a very helpful job of explaining these  
 3 various terms in paragraph 4(i), but to me it's  
 4 noticeable that you didn't say anything about the words  
 5 "exclusive of stand-by units", which appears here in  
 6 Appendix II, paragraph 4(i). But I think I have it  
 7 correct that it's also in Appendix I, paragraph 3(d);  
 8 Appendix III, paragraph 4(g); and if we go over to  
 9 Annexure E, we've also got it in the appendix at  
 10 paragraph 4(g)(v).  
 11 Obviously, the Treaty-drafters thought it important  
 12 to have those words in there. And I guess my basic  
 13 question is: what's the significance of having those  
 14 words, for the issues that we're trying to determine in  
 15 this Second Phase?  
 16 PROFESSOR WEBB: Thank you. That is a different point to  
 17 what I was moving on to, Mr Chairman. Thank you.  
 18 I'd like to have the opportunity to consult the  
 19 manuals that we have been using to give you the ordinary  
 20 meaning as well. So that is noted for coming back to  
 21 you. Thank you.  
 22 (Slide 32) Now, as I said, I'm turning to a temporal  
 23 observation, which is that Pakistan's approach to the  
 24 term or the concept "anticipated load" is calibrated to  
 25 the Northern Region Grid today, and the place of

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12:29 1 So undefined terms or concepts "must be considered  
 2 as they are typically used for the design and operation  
 3 of run-of-river HEPs". What is typical of a HEP design  
 4 in India today is for the anticipated load to be  
 5 calculated by reference to the HEP's role in the actual  
 6 power system to which it is expected to contribute,  
 7 the Northern Region Grid.  
 8 Now, the Court of course also states here that  
 9 undefined terms may be understood "as they were used at  
 10 the time the Treaty was adopted", but we note that that  
 11 was a general statement by the Court, a preferred  
 12 position in general, but it was not a mandated approach.  
 13 And indeed, turning to the correspondence that  
 14 we have on the record, Pakistan and India have  
 15 themselves treated the issue of load as being dependent  
 16 on the HEP's role in the wider power system, even if  
 17 India did not always apply that approach correctly in  
 18 Pakistan's submission. The principle of the approach  
 19 was accepted by both Parties.  
 20 (Slide 33) This is a busy slide, but this is  
 21 extracts of correspondence between 1984 up until the  
 22 minutes of meetings in 2017, and all the references to  
 23 your bundles and the exhibits are there.  
 24 The point to take from this is that as larger  
 25 regional grids began to replace smaller local grids in

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12:31 1 India, the Parties understood that this would affect  
 2 the anticipated load fluctuations, and Pakistan has  
 3 consistently taken the view that a non-hypothetical load  
 4 curve must necessarily consider the role of the HEP in  
 5 the regional power system.  
 6 So in 1984 -- this is starting at the top, and I'm  
 7 just going to highlight the main points from these -- in  
 8 relation to Dul Hasti (Exhibit P-0649.0513), the Indian  
 9 Commissioner said that:  
 10 "[The] plant would be required to ... operate[] in  
 11 the grid and has to provide [the] necessary peaking  
 12 capacity under the varying conditions ..."  
 13 In 1993, also in relation to Dul Hasti  
 14 (Exhibit P-0649.0795), the Indian Commissioner again  
 15 referred to the power station "operat[ing] in the grid"  
 16 and "provid[ing] [the] necessary peaking capacity".  
 17 In 1995, Pakistan, on Dul Hasti  
 18 (Exhibit P-0649.0833), said that:  
 19 "... the load curve ... was a hypothetical one and  
 20 ha[d] not been based on the actual operation of the  
 21 Plant [that] would be grid[d]ed nation wide."  
 22 The Indian Commissioner, in relation to Baglihar  
 23 (Exhibit P-0649.0814), again talked about needing to  
 24 look at the place of the HEP in whole and not as  
 25 "an isolated distribution system".

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12:34 1 balancing power for stabilizing the grid and for  
 2 successful integration of ... renewables" meant that  
 3 they needed more flexibility with regard to hydropower.  
 4 So what to draw out of these exchanges: that both  
 5 Parties agree that the role of the grid and the role of  
 6 the HEP in the grid are important, and what we have is  
 7 the continuing disagreement, as already laid out  
 8 earlier, over the level of detail and precision [with  
 9 which] India is approaching this question.  
 10 I will conclude Mr Chairman, members of the Court,  
 11 by recalling the key paragraphs from the Court's General  
 12 Issues Award that informed the approach to the  
 13 calculation of pondage. These are very familiar to  
 14 everyone, so I won't read them out in terms.  
 15 (Slide 34) Paragraphs 745 to [748] set out the  
 16 court's approach pursuant to paragraph 8(c) and notes  
 17 three restrictions in that regard.  
 18 (Slide 35) Paragraph 742 makes the important point  
 19 on burden of proof that:  
 20 "... if a difference emerges between the Parties,  
 21 it is for India, as the proponent of the design and  
 22 construction of the HEP, to establish that the proposed  
 23 maximum Pondage satisfies the requirements of  
 24 Paragraph 8(c), bearing in mind any Pakistani position  
 25 that a more Treaty-compliant alternative exists."

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12:33 1 The Pakistan Commissioner in 1994  
 2 (Exhibit P-0649.0822) said again that:  
 3 "... the load demand curve supplied is hypothetical  
 4 ... [and] has been drawn only to achieve ... maximum  
 5 pondage."  
 6 In 1996 (P-0649.0850), the Indian Commissioner  
 7 referred to the load demand curve assuming any  
 8 pattern -- may be able to "assume any pattern which  
 9 cannot be predicted".  
 10 We then get into the minutes of the Secretary-level  
 11 meetings on Baglihar in 1995 (Exhibit P-0650.1), where  
 12 the Indian Commissioner noted:  
 13 "For the designed operation/role of the station in  
 14 the grid, the Pondage has been worked out and supplied."  
 15 India also said in the record of the Permanent Indus  
 16 Commission meeting in 2010 (Exhibit P-0330) that:  
 17 "... in [the] future, [the] Ladakh region would be  
 18 inter-connected to the Northern Regional Grid of India."  
 19 And in the 2017 Indus Commission meeting  
 20 (Exhibit P-0103), Pakistan's Commissioner noted that the  
 21 way that India had gone about its pondage computation  
 22 was designed to maximise pondage using a hypothetical  
 23 load curve and "the real load curve of the area" -- that  
 24 is, the Northern Grid -- "was [thereby] comprised".  
 25 The Indian Commissioner responded that "the need for

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12:35 1 And as set out in paragraph 743, the litmus test is  
 2 "how the plant will actually be operated".  
 3 So India is not permitted pondage for the sake of  
 4 pondage; it's not permitted pondage for the sake of  
 5 assumed operational flexibility that is not based on  
 6 the actual anticipated load of the plant.  
 7 And it is once a plausible model of daily and weekly  
 8 HEP operation is established that we have a realistic,  
 9 well-founded and defensible understanding of installed  
 10 capacity and anticipated load that will play a role in  
 11 the methodology that the Court has set out.  
 12 (Slide 36) At paragraph 705, the Court noted,  
 13 importantly, that:  
 14 "... the general approach in the Treaty is not to  
 15 reduce the design of a Run-of-River HEP to  
 16 the application of unique formulas."  
 17 This point I think is well understood. And that  
 18 the test is realistic, well-founded and defensible.  
 19 While the Treaty does not expressly limit the  
 20 installed capacity or anticipated load of  
 21 an Annexure D.3 HEP, limitations do necessarily follow  
 22 from the Court's analysis with regard to other design  
 23 features of the HEPs.  
 24 So in addition to paragraph 8(c), other provisions  
 25 impose implicit limits on installed capacity and

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<p>12:37 1 anticipated load. These again are very familiar to the 2 Court: paragraph 8(a) on not raising artificially the 3 water level in the operating pool above the full pondage 4 level; paragraph 8(b) on taking into account the 5 requirements of surcharge storage and secondary power; 6 paragraph 15 and its operational constraints; and also, 7 more contextually in the Treaty, the difference between 8 an Annexure D run-of-river HEP and an Annexure E storage 9 work, so that the installed capacity and anticipated 10 load of a proposed Annexure D HEP cannot, in effect, 11 lead to a design outcome that is in fact closer in 12 character to a storage work under Annexure E. 13 (Slide 37) Mr Chairman, coming back full circle to 14 the data issues that I addressed at the outset, India is 15 required to communicate to Pakistan this long list of 16 important data with respect to each HEP under 17 paragraph 9 and Appendix II of Annexure D. These data 18 reinforce the Parties' acknowledgement that limits on 19 installed capacity and anticipated load are appropriate 20 under the Treaty, at least when they were concluded in 21 1960. 22 Unless there are questions, Mr Chairman and members 23 of the Court, I would ask that you call Dr Miles to 24 address you on the legal aspects of installed capacity 25 and anticipated load.</p> <p style="text-align: center;">Page 101</p>	<p>12:40 1 Now, I think that India might point out in support 2 of this that the existence of a regional grid now 3 encompassing many HEPs provides that no single HEP needs 4 to conform to the regional grid requirements but rather 5 to operate in tandem with the other HEPs, to give India 6 maximum flexibility in meeting its anticipated loads. 7 All of that is to say that I think this is 8 an argument that the Court has to confront. And I'm not 9 asking you to present here, but perhaps at some point in 10 Pakistan's presentation they can provide succinctly 11 the points that we should consider, particularly any 12 provisions of the Treaty, that disfavour this approach. 13 PROFESSOR WEBB: Yes, thank you, Professor Minear. 14 We will come back on the specific points and it's 15 very useful to have them laid out. But I will just, as 16 an initial response, say that the idea that the Treaty 17 is about the complete and satisfactory utilisation of 18 the waters is starting several steps down the framework 19 of the Treaty. 20 As the Court has accepted in its previous award, 21 this is a very special kind of treaty akin to a boundary 22 treaty. It is based on three bargains: the peace 23 bargain, the treaty bargain and the hydropower bargain. 24 The Western Rivers hydropower bargain is where we get 25 the reference to the ability to satisfactorily use the</p> <p style="text-align: center;">Page 103</p>
<p>12:38 1 THE CHAIRMAN: Thank you, Professor Webb. 2 Professor Minear. 3 PROFESSOR MINEAR: Thank you, Professor Webb, for that 4 discussion. I regret again that our colleagues from 5 India are not here to present their perspective on these 6 matters. Just as Sir Daniel expressed some perplexity 7 with our decision, I think India might have some 8 consternation as well. 9 But in imagining what India might say if they were 10 present here, I would think that India might argue the 11 primary purpose of the Treaty is to obtain "the most 12 complete and satisfactory utilisation of the waters of 13 the Indus system", and that this purpose is best served 14 by allowing India broad flexibility in installing 15 pondage during the dry season, subject only to the 16 Treaty requirements that India calculate firm power made 17 on the MMD and India comply with the release 18 requirements at paragraph 15 of Annexure D. 19 In other words, India might propose to calculate 20 maximum pondage using the MMD but applying whatever 21 daily and weekly loading requirements that India's dam 22 designers select for the particular HEP, and that might 23 be, in fact, what the historic record shows they were 24 doing, and their only constraint is the paragraph 15 25 release requirements that must be met.</p> <p style="text-align: center;">Page 102</p>	<p>12:41 1 waters, but that is subject to everything that comes 2 before that, including the idea that this was to settle 3 things over an important area and resource, but also to 4 give reassurance to Pakistan, that had suffered the 1948 5 crisis, that it would not happen again. 6 So it's a very narrow provision for India, subject 7 to all of these constraints, and it's not the starting 8 point of the analysis. 9 PROFESSOR MINEAR: Thank you, Professor. 10 THE CHAIRMAN: Professor Webb, just a few questions from me. 11 I think I heard you just say before you closed that 12 paragraphs 8(a) and 8(b) of Annexure D are relevant and 13 impose an implicit limit on installed capacity and 14 anticipated load, and I believe you said that as well in 15 the Memorial at paragraph 3.30. 16 I'm not entirely clear in my own mind what implicit 17 limits arise from paragraphs 8(a) and 8(b) with respect 18 to the issues we're dealing with in this Second Phase. 19 So if you're, either now or later, able to clarify that 20 for me, I'd be grateful. 21 PROFESSOR WEBB: Yes, we'll come back to clarify that, 22 Mr Chairman. But I think 8(a) and 8(b) are particularly 23 contextual elements of treaty interpretation, rather 24 than, in terms, directly impacting on installed capacity 25 and anticipated load. But it's this general idea of the</p> <p style="text-align: center;">Page 104</p>

12:43 1 amount of control that India has over the water.  
 2 THE CHAIRMAN: Okay, thank you.  
 3 I don't think you mentioned paragraph 17 of  
 4 Annexure G to the Treaty. That's the paragraph that  
 5 allows for a permissible tolerance of 10% in volume with  
 6 respect to the requirements of paragraph 15.  
 7 Now, I know that, based on Sir Daniel's earlier  
 8 presentation, there's an interest here in the  
 9 relationship of paragraph 15 to the issue of the  
 10 anticipated load and installed capacity. But just  
 11 setting that issue aside for the time being, I would be  
 12 interested in your thoughts on the significance, if  
 13 anything, of that tolerance that is identified as it  
 14 might relate to the determinations before us in this  
 15 phase.  
 16 PROFESSOR WEBB: Thank you, Mr Chairman. I will note that  
 17 and come back to you on that. Thank you.  
 18 THE CHAIRMAN: Very good.  
 19 My third and final question is: you did touch on  
 20 the idea of a presumption that might be arising from  
 21 the notification requirements --  
 22 PROFESSOR WEBB: Yes.  
 23 THE CHAIRMAN: -- and I believe that -- or perhaps you put  
 24 it in terms of burden of proof; I think it might have  
 25 been Sir Daniel who said that there could be

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12:45 1 a presumption operating that could be relevant for  
 2 the Court's consideration.  
 3 My question is this: to the extent that much turns  
 4 on what it is India is obliged to provide to Pakistan  
 5 pursuant to paragraph 9 and Appendix II of Annexure D,  
 6 how should the Court be thinking about the fact that  
 7 certain types of information that Pakistan views as  
 8 relevant isn't included in, for example, Appendix II?  
 9 So, for example, Pakistan is about to present to us on  
 10 data relating to the grid: that data is not captured,  
 11 expressly at least, in Appendix II.  
 12 So it raises just a general issue that if some sort  
 13 of burden of proof is to be applied or a presumption is  
 14 to be applied, how should the Court be thinking about  
 15 the express terms of Appendix II versus things that are  
 16 not express, but might be implied or might not be  
 17 implied in Appendix II.  
 18 PROFESSOR WEBB: Yes, thank you, Mr Chairman. I think  
 19 we would want to take a more granular look at that in  
 20 response to your question.  
 21 But just on the point of the grid, that is something  
 22 that, as I illustrated in the correspondence, both  
 23 Parties have accepted as relevant. The data underlying  
 24 that is still a point of disagreement, but at least  
 25 there is consensus on it being important to look at

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12:46 1 the HEP and the power system.  
 2 THE CHAIRMAN: Well, just to follow up on that, I think it  
 3 was on your own slide a few slides back (33), where you  
 4 indicated at a certain point an objection by Pakistan to  
 5 a load curve because it was "not based on the actual  
 6 operation of the Plant which would be grid[d]ed  
 7 nation wide".  
 8 What wasn't clear to me from the historical  
 9 record -- and this connects to an earlier question --  
 10 is: did India ever provide information on the national  
 11 grid? If not, presumably Pakistan already had access to  
 12 that information and was using it to determine whether  
 13 the load curve was hypothetical or not.  
 14 But then that just raises the issue: do we think  
 15 that information is required under Appendix II, or was  
 16 it understood as being readily available information at  
 17 the time the Treaty was concluded, during the life of  
 18 the Treaty, such that whatever burden of proof or  
 19 presumption might arise with respect to Appendix II  
 20 would not apply to that particular data?  
 21 That's the kind of question that would be helpful to  
 22 hear from you in due course on.  
 23 PROFESSOR WEBB: Yes. Thank you, Mr Chairman.  
 24 THE CHAIRMAN: Very good. I think that concludes our  
 25 questions for you, Professor Webb. Thank you very much

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12:48 1 for your presentation; it was, as always, quite helpful.  
 2 Let me turn to Sir Daniel. We are about ten minutes  
 3 from the break point for lunch. I think probably the  
 4 Court would just as soon break now, to allow Dr Miles  
 5 a clear runway when we come back. So we could resume  
 6 the afternoon session at [1].50, if that's agreeable to  
 7 Pakistan. (Pause)  
 8 SIR DANIEL: We would be very content with that. Thank you,  
 9 Mr Chairman.  
 10 THE CHAIRMAN: Very good. Thank you.  
 11 Sir Daniel, if I can also just ask whether your  
 12 sense of the timing for your presentations is relatively  
 13 on track or whether we've slipped behind in any  
 14 significant regard.  
 15 SIR DANIEL: Mr Chairman, I think that we were anticipating,  
 16 as I said in my opening remarks, that Dr Miles would be  
 17 on his feet for about 90 minutes and then Mr Rae for  
 18 about 90 minutes. So I think that we are on track.  
 19 We had reserved a little bit of time for some closing  
 20 submissions from me, but as I anticipated, those can be  
 21 held over for tomorrow. So unless I hear shouts over  
 22 lunch to say that there's a problem, I think that we are  
 23 on track.  
 24 THE CHAIRMAN: Very good.  
 25 SIR DANIEL: I should add, Mr Chairman, that of course that

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12:49 1 depends on you.  
 2 THE CHAIRMAN: Well, we realise that we're slowing you down  
 3 at times, but I'm sure you appreciate that the whole  
 4 point in us being here is to have the Court pose these  
 5 questions to you, and we're very thankful for the  
 6 responses you've already provided and will provide.  
 7 Okay, let's break for one hour, and I look forward  
 8 to seeing you this afternoon.  
 9 (12.50 pm)  
 10 (Adjourned until 1.50 pm)  
 11 (1.50 pm)  
 12 THE CHAIRMAN: Alright. Well, I hope everyone had  
 13 a pleasant and relaxing lunch, even if it was relatively  
 14 brief. We are back in session and Dr Miles is at the  
 15 podium, so I invite him to proceed with his  
 16 presentation.  
 17 DR MILES: (Slide 1) Thank you, Mr Chairman, members of  
 18 the Court. It is an honour to be before you again on  
 19 behalf of the Islamic Republic of Pakistan.  
 20 (Slide 2) Now, diving straight in, Pakistan's  
 21 purpose here today is to assist the Court in developing  
 22 the interpretation of paragraph 8(c) of Annexure D set  
 23 down in its General Issues Award, and specifically to,  
 24 as we can see on the slide:  
 25 "... 'resolv[e] the basis upon which India must

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13:52 1 anticipated load.  
 2 And then following on from that, I will also be  
 3 dealing with the following two items, which are:  
 4 "Pakistan's current position on how those elements (once  
 5 determined), along with others, are to be taken into  
 6 account for purposes of the calculation of maximum  
 7 Pondage", that's 2.3.6; and "Any other issues Pakistan  
 8 considers relevant to a decision on the questions at  
 9 issue for the Second Phase on the Merits", that's 2.3.7.  
 10 Now, as the Court will appreciate, and as Pakistan  
 11 has elaborated, the Court's interpretation of  
 12 paragraph 8(c) in its General Issues Award has both  
 13 legal and engineering elements. Mr Rae and myself have  
 14 divided these between us. So while my presentation on  
 15 legal matters will, of necessity, incorporate some  
 16 basic -- and I emphasise "basic" -- engineering, I will  
 17 ask you to hold your questions of serious technical  
 18 detail for Mr Rae, who I am sure will be itching to  
 19 address them.  
 20 (Slide 4) So with that roadmap set out, I'll turn to  
 21 my first section. Here I propose to deal with the basis  
 22 on which, in Pakistan's view, installed capacity and  
 23 anticipated load must be determined by India in the case  
 24 of a run-of-river HEP on the Western Rivers.  
 25 (Slide 5) So I'd like to start this section by

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13:51 1 determine the installed capacity and anticipated load of  
 2 a proposed Annexure D, Part 3 HEP, and, once determined,  
 3 how [those] elements are to be taken into account for  
 4 the purposes of the calculation of maximum Pondage' ..."  
 5 That is what is defined, in the recital on the slide  
 6 (PO17, recital 11), as the "Capacity/Load/Pondage  
 7 Calculation Issues".  
 8 Now, in that same PO17 at paragraph 2, the Court  
 9 posited a series of subjects that it would like to see  
 10 dealt with in Pakistan's Memorial on the Second Phase on  
 11 the Merits, which we duly adopted as the structure of  
 12 that Memorial and indeed as the scheme of our  
 13 submissions.  
 14 (Slide 3) Where we are currently, following  
 15 presentations from Sir Daniel and Professor Webb, is  
 16 here, at paragraph 2.3.5:  
 17 "Pakistan's current position as to the basis upon  
 18 which India must determine the installed capacity and  
 19 anticipated load of a proposed Annexure D, Part 3 HEP,  
 20 including what limits, if any, the Treaty places on  
 21 India's discretion in this respect ..."  
 22 Professor Webb has just finished dealing with the  
 23 second clause in that sentence on Treaty-interpretive  
 24 issues. I will be dealing with the first part, which is  
 25 Pakistan's current position on installed capacity and

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13:53 1 picking up where Professor Webb left off, which is the  
 2 Court's General Issues Award. She has already addressed  
 3 you on the material parts of that award, and in  
 4 particular on what is set out in paragraphs 742 to 748  
 5 and then at [part] O of the dispositif.  
 6 From these paragraphs, in Pakistan's submission,  
 7 it is possible to derive four general principles for the  
 8 calculation of installed capacity and anticipated load.  
 9 We can see them on the slide.  
 10 Our first principle is definitional: it is simply  
 11 a repetition of what "installed capacity" and  
 12 "anticipated load" mean within the schema of the Court's  
 13 reasoning.  
 14 So installed capacity is the total power capacity of  
 15 the HEP's turbines, ordinarily measured in megawatts.  
 16 That's fairly easy to determine, as it is a basic vital  
 17 statistic for any power plant. So in the Kiru HEP  
 18 referred to in the General Issues Award, for example,  
 19 the installed capacity is 624 MW.  
 20 Anticipated load, however, is the load that can be  
 21 expected -- that is, anticipated -- to be placed on the  
 22 HEP by the power system over daily and weekly time  
 23 periods.  
 24 That's the first principle.  
 25 Our second principle starts to tell us how these

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13:55 1 things are to be calculated by reference to the Court's  
 2 rubric of a "realistic, well-founded, and defensible"  
 3 projection, as deployed in paragraph 747 of the  
 4 General Issues Award.  
 5 Now, these words were doubtlessly chosen with great  
 6 care by the Court. But the question that Pakistan has  
 7 been preoccupied with, and which prompted the request  
 8 that eventually led to, but was not resolved by, the  
 9 Clarification Decision, was: what do these words mean?  
 10 (Slide 6) Now, this is not, strictly speaking,  
 11 a question of Treaty interpretation, as these words are  
 12 a product of the Court's reasoning, and not of the  
 13 Treaty's text, save indirectly. But it's worth noting  
 14 that the Kishenganga Court, at paragraph 397 of its  
 15 partial award (PLA-0003), had recourse to dictionary  
 16 definitions in defining "necessary" within the meaning  
 17 of paragraph 15(iii) of Annexure D, and so we can see  
 18 from the slide it had recourse to both the ordinary and  
 19 the American OED.  
 20 (Slide 7) So with that in view, it's probably worth  
 21 considering what dictionaries say about "realistic,  
 22 well-founded, and defensible". Now, I didn't have  
 23 a copy of the American OED in chambers, but I did have  
 24 Webster's, so you're going to get the Shorter Oxford and  
 25 the Webster's here (P-0172, P-0173). But we can see

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13:56 1 from the definitions on the slide that all three terms  
 2 are sort of getting at something similar.  
 3 "Realistic" means "Characterised by fidelity of  
 4 representation; representing things as they really are",  
 5 or alternatively, "Facing reality squarely: not  
 6 impractical or visionary".  
 7 "Well-founded" means "Built on a firm or solid  
 8 base", or "having a foundation in fact or reason, based  
 9 on good grounds and evidence", or "Constructed on  
 10 a solid or firm foundation", and it can also mean  
 11 "Having a firm foundation in fact: based on excellent  
 12 reasoning, information, judgment and grounds".  
 13 And "defensible" means "Able to be defended; easily  
 14 defended; justifiable", or simply "Capable of being  
 15 defended".  
 16 So if we take all of these together, they tend to  
 17 indicate, at least in Pakistan's submission, that  
 18 India's calculation of installed capacity and  
 19 anticipated load must reflect reality, must be backed by  
 20 good evidence and it must be capable of withstanding  
 21 scrutiny from a third party, namely Pakistan.  
 22 As a consequence, in Pakistan's submission,  
 23 the Court's rubric places a strict standard on India.  
 24 India's understanding of a proposed HEP's installed or  
 25 anticipated load must be capable of being defended by

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13:57 1 reference to objective reality and with actual evidence.  
 2 Blind assertions of "Trust me, friend" by India will not  
 3 work, not in this space.  
 4 (Slide 8) Now, with this understanding of the  
 5 Court's rubric in hand, we can start to move into the  
 6 third general principle which emerges from the critical  
 7 part of the General Issues Award, which is back on the  
 8 slide, and it's the idea that if India is required to  
 9 ground the installed capacity and anticipated load of  
 10 a proposed HEP in reality and by reference to evidence,  
 11 then it follows that if Pakistan challenges India's  
 12 position, then India is obliged to defend it; or, to put  
 13 it in legal terms which we were discussing earlier,  
 14 the burden of proof.  
 15 (Slide 9) This is also not a surprising principle,  
 16 in my submission, because it tracks the language of  
 17 paragraph 742 of the General Issues Award, which is back  
 18 on the slide. Where Pakistan raises a timely objection  
 19 to the maximum pondage of a proposed HEP under  
 20 paragraph 8(a), the Court has told us that India must  
 21 give them careful consideration, and both Parties must  
 22 proceed in a spirit of cooperation and good faith.  
 23 Ultimately, if a difference emerges in this regard  
 24 between the Parties, it is for India, as the proponent  
 25 of the design and construction of the HEP, to establish

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13:59 1 that the proposed maximum pondage satisfies the  
 2 requirements of paragraph 8(c), bearing in mind any  
 3 Pakistani position that a more Treaty-compliant  
 4 alternative exists.  
 5 Equally, another corollary emerges from this  
 6 formulation, which is that India must place Pakistan in  
 7 a position to assess and, if necessary, to challenge  
 8 India's projections of installed capacity and  
 9 anticipated load in a timely manner, under paragraph 9  
 10 of Annexure D. And that's derived from earlier wording  
 11 in that same paragraph, still on the slide:  
 12 "... to fulfil its Treaty obligations, India must  
 13 include information and explanation relating to its  
 14 calculation of maximum Pondage ... India's notification  
 15 must give Pakistan sufficient time to respond with its  
 16 views as to whether the design is compliant with the  
 17 Treaty."  
 18 So that's principle 3.  
 19 (Slide 10) This brings me to principle 4, which is  
 20 based on the language, again carefully chosen by the  
 21 Court, in paragraph 743 of the General Issues Award.  
 22 Now, we've already looked at the dictionary definitions  
 23 of "realistic, well-founded, and defensible" with  
 24 respect to installed capacity and anticipated load,  
 25 which indicate that India's projected installed capacity

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14:00 1 and anticipated load must reflect reality and must be  
 2 backed by evidence. But in 743, the Court hit upon  
 3 another possible way of saying the same thing, which is  
 4 that:  
 5 "... [a]s a general matter, the plant's installed  
 6 capacity and anticipated load must correspond to how the  
 7 plant will actually be operated; it cannot be  
 8 hypothesized in a manner that serves to inflate  
 9 the amount of maximum Pondage'."  
 10 Now, in Pakistan's submission, this is one of the  
 11 most important things the Court said in the General  
 12 Issues Award, at least insofar as pondage was concerned.  
 13 In short, India is entitled to the installed capacity  
 14 and anticipated load that it needs to run the HEP within  
 15 its ultimate practical context; no less, and certainly  
 16 no more.  
 17 (Slide 11) And the Court was obviously well aware of  
 18 its importance as well, for this informed its decision  
 19 in PO19 to request that India produce operational data  
 20 for the Baglihar HEP and the KHEP in order to discover,  
 21 with respect to these already completed plants, how they  
 22 actually operated. Again, the Court emphasised at  
 23 paragraph 35 of the procedural order exactly the same  
 24 language we see on the slide:  
 25 "... [a]s a general matter, the plant's installed

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14:03 1 installed capacity and anticipated load could be based  
 2 on an assumed hydrological supply greater than that  
 3 which the river at the HEP site could actually provide.  
 4 First of all, and most obviously, this is going to  
 5 have quite a big impact on your installed capacity,  
 6 because the fuel supply is going to determine how much  
 7 energy the plant can actually be expected to supply.  
 8 If I can put this into very basic Australian terms,  
 9 there's no point in putting a V8 engine into a car with  
 10 a two-litre fuel tank. If I can put it into slightly  
 11 less Australian terms, however, which reflects the  
 12 example given in the Memorial, the KHEP is at a site  
 13 with an MMD of 18.59 cubic metres per second, so  
 14 comparatively low, given the wider flows on the Western  
 15 Rivers. Likewise, the observed and daily discharge  
 16 figures provided by India, as well as the applicable  
 17 flood data, indicate that this part of the Kishenganga  
 18 has a fairly gentle flow, year round, when compared to  
 19 something like the Chenab Main.  
 20 Now, that flow is sufficient to justify a 330 MW  
 21 plant like the KHEP. But it would not be sufficient to  
 22 justify something like India's planned 1856 MW Swalkot  
 23 HEP, which is actually being built on the Chenab Main  
 24 below Ramban, at a site with one of the highest average  
 25 flows of the Western Rivers in territory controlled by

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14:01 1 capacity and anticipated load must correspond to how the  
 2 plant will actually be operated; it cannot be  
 3 hypothesized in a manner that serves to inflate the ...  
 4 Pondage'."  
 5 This, in turn, brings me on to the meat of this part  
 6 of my submissions, which is describing from  
 7 a layman's -- or perhaps from a mere lawyer's --  
 8 perspective the principal engineering constraints of how  
 9 a HEP is actually operated, and how this may feed into  
 10 a realistic, well-founded and defensible projection of  
 11 installed capacity and anticipated load. Now, of course  
 12 Mr Rae is going to go through all of this in greater  
 13 detail by reference to real-world examples, but I will  
 14 attempt to give you a high level preview.  
 15 In essence, in Pakistan's submission, there are two  
 16 key factors that need to be taken into account in this  
 17 respect, which might broadly be thought to correlate to  
 18 the HEP's input and output, namely the hydrology at the  
 19 HEP site, on the one hand; and on the other, the power  
 20 system to which the HEP is expected to contribute.  
 21 (Slide 12) So starting with hydrology. This is  
 22 obviously relevant to how the HEP is actually going to  
 23 operate because it's the fuel source for the plant.  
 24 In short, it cannot be credibly contended that  
 25 a realistic, well-founded and defensible projection of

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14:04 1 India.  
 2 A plant like Swalkot, if it was put at the KHEP  
 3 site, would have surplus generation capacity that would  
 4 be idle for much of the year. The flow just wouldn't be  
 5 high enough for the actual plant to be used to its full  
 6 capacity. And so the installed capacity of that plant,  
 7 placed at the KHEP site, would not be realistic,  
 8 well-founded and defensible.  
 9 How the river hydrology will affect the anticipated  
 10 load is perhaps a little more the abstract, but it can  
 11 be readily understood. Anticipated load determines not  
 12 just how much power the plant is expected to produce,  
 13 but also when it is expected to produce it.  
 14 Absent flood events, we do know that the  
 15 hour-to-hour flow on the Western Rivers is relatively  
 16 stable. So it follows that if India were to project  
 17 a HEP's anticipated load on the basis of sudden rapid  
 18 hourly increases in the flow on whatever the HEP site  
 19 was, then this also would not be considered to be  
 20 realistic, well-founded and defensible, as the river  
 21 simply could not be expected to behave in that way.  
 22 So that's hydrology.  
 23 THE CHAIRMAN: Dr Miles, if I can --  
 24 DR MILES: Please.  
 25 THE CHAIRMAN: -- and you may be getting to this at a later

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14:05 1 point, but I'm wondering: in terms of this issue of the  
 2 installed capacity and the hydrology of the river, when  
 3 I looked at the Court's Excel table, to use the shorter  
 4 term, and tried manipulating it a little bit, it did  
 5 seem that the installed capacity issue played a very  
 6 small role in the potential for generating pondage.  
 7 It's not non-existent, but it's limited. It seemingly  
 8 diminishes as you try to expand the capacity and so on.  
 9 And I did note in your Memorial that at paragraphs 4.7  
 10 and 4.8, when Pakistan reflected on the sense that the  
 11 Court had of its limited role, you tended to agree that  
 12 the effect on the volume of the pondage was rather  
 13 small.  
 14 So could you then perhaps address that a little bit  
 15 in the context here that you're talking about? Because  
 16 while I understand that massive capacity doesn't make  
 17 sense, in certain circumstances it seems not to make  
 18 sense as well in the context of trying to manipulate  
 19 pondage.  
 20 DR MILES: First of all, I'd just agree with the underlying  
 21 premise of the question -- I don't think it was even  
 22 underlying, I think it was the overt premise of the  
 23 question -- that when you start playing around with  
 24 the installed capacity, it doesn't have a huge impact on  
 25 what's actually going on with the pondage. I think

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14:08 1 in Creager and Justin's Hydroelectric Handbook  
 2 (Exhibit P-0309), with which the Court by now is very  
 3 familiar, the authors expressly state, and we can see on  
 4 the slide, that:  
 5 "The advisable capacity of a hydroelectric project  
 6 depends on the extent to which the installation may be  
 7 utilised within the limits of the connected load  
 8 curve ..."  
 9 Which is to say the power system.  
 10 Now, the load curve, as the Court knows, shows  
 11 fluctuating demand within the power system on a daily or  
 12 weekly basis.  
 13 Now, before I go any further, a couple of  
 14 observations about load curves.  
 15 The first one, which may be obvious, is that there's  
 16 no such thing as a single load curve for a power system.  
 17 The load curve is shaped by demand, demand is shaped by  
 18 people, and people behave at different ways at different  
 19 times. The load on the power system will therefore  
 20 change minute to minute, hour to hour, day to day, week  
 21 to week and month to month. So when the Court talks, in  
 22 the General Issues Award, about using a load curve to  
 23 determine installed capacity and anticipated load, the  
 24 obvious response from Pakistan is: well, which load  
 25 curve?

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14:07 1 Mr Rae certainly has some views on that, and maybe will  
 2 address you further in due course.  
 3 But the flipside of that, of course -- and this is  
 4 what I will be spending most of my time talking about  
 5 today, at least in the context of these remarks -- is  
 6 that anticipated load is by far and away a much more  
 7 important factor in the calculation of pondage. So I'll  
 8 be targeting my submissions mostly on that.  
 9 But insofar as -- if you're asking whether or not  
 10 we stand by the relevant paragraphs in Chapter 4 of  
 11 the Memorial, the answer is: yes, we do.  
 12 THE CHAIRMAN: Thank you.  
 13 DR MILES: That's hydrology.  
 14 Turning now to the power system, which is the other  
 15 factor in determining installed capacity and anticipated  
 16 load -- and I'll be spending most of my time, as I say,  
 17 on anticipated load -- it's a more significant factor  
 18 again than the hydrology, is the power system. And  
 19 that's because when we ask ourselves the question of how  
 20 the HEP operates, the answer is, in the broadest sense,  
 21 in accordance with demand. That demand is provided by  
 22 the power system -- that is to say the grid -- into  
 23 which the plant is designed to feed.  
 24 (Slide 13) Now, this is something that would have  
 25 been well understood by the Treaty's drafters. Indeed,

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14:09 1 Now, second, notwithstanding what I just said, load  
 2 curves tend not to change year to year, at least not in  
 3 any sense significant for our purposes. And that's  
 4 because while people may be doing different things in  
 5 February 2026 to what they will be doing in August 2026,  
 6 what they were doing in January 2026 is probably not so  
 7 different to what they were doing in January 2025.  
 8 I, for example -- and I suspect the Court as well -- was  
 9 spending too much time thinking about what  
 10 paragraph 8(c) means.  
 11 Now, this yearly stability is what make load curves  
 12 useful in power planning. While gross demand may grow,  
 13 the point at which the power is to be provided to meet  
 14 that demand is unlikely to change. And again, the  
 15 Hydropower Handbook (P-0309) recognises this much.  
 16 We can see again on the slide:  
 17 "If one examines the weekly load curves for any  
 18 given system for the past few years, he will be  
 19 impressed by the similarity of the shape of the weekly  
 20 load curve for any given period in the year. Thus, if  
 21 one were to take a typical weekly load curve for October  
 22 of a recent year and multiply the ordinates by the  
 23 growth ratio between the two periods, he would closely  
 24 approximate the actual weekly load curve for October of  
 25 the later year. This similarity in the shape of the

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14:11 1 weekly load curve for any given period of the week makes  
 2 this curve particularly valuable in helping to determine  
 3 how a proposed hydro plant may be fitted to the load  
 4 curve."  
 5 So far, so good. But how do we use a load curve --  
 6 reflective of demand on the power system -- to produce  
 7 a realistic, well-founded and defensible projection of  
 8 installed capacity and anticipated load for an Indian  
 9 HEP on the Western Rivers?  
 10 (Slide 14) So on the slide we have a sample load  
 11 curve, pulled also from the Hydroelectric Handbook  
 12 (P-0309), for a week in December 1960, or thereabouts.  
 13 Now, this shows a system with a peak load of  
 14 1,300 MW, that's the red arrow, and a minimum load of  
 15 700 MW, the green arrow. Demand is lower on the  
 16 weekend, but it's higher during the week, with each of  
 17 those weekdays showing two peak periods, denoted with  
 18 the blue arrows: the first from 8.00 am to noon, and the  
 19 second from 5.00 pm to 10.00 pm.  
 20 Now, again, I'll start with installed capacity,  
 21 address it briefly, before going on to anticipated load.  
 22 But installed capacity is relatively straightforward.  
 23 As we know, a run-of-river HEP with pondage on  
 24 the Western Rivers is going to be doing different things  
 25 at different points in the year. The Court will recall

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14:12 1 in this respect Mr Khan and Mr Malik's presentation on  
 2 the site visit.  
 3 In the wet season, the HEP is going to be running in  
 4 baseload mode. Rain and snowmelt will result in a huge  
 5 increase in flow compared to the dry season. Now, that  
 6 installed capacity is ordinarily going to be fixed by  
 7 reference to your wet-season flow, as this is when the  
 8 installed capacity will be playing a significant role in  
 9 the power system, by which I mean it will have a greater  
 10 number of generating hours, and the plant operator is  
 11 therefore going to be able to make more money.  
 12 In other words, the load curve reflecting wet-season  
 13 demand would be the usual reference point when  
 14 determining installed capacity. Now, that being said,  
 15 the installed capacity must still bear a rational  
 16 relationship to that power system.  
 17 On our slide, we see that the demand in our sample  
 18 power system never exceeds 1,300 MW. So let's imagine  
 19 for a second what happens if we plug the Swalkot HEP,  
 20 1,856 MW, into that power system. Well, it would exceed  
 21 the total capacity of the power system, it would  
 22 effectively overwhelm it; it would be a disaster. But  
 23 again, the 330 MW Kishenganga HEP could be justified  
 24 within this load curve, depending on what other power  
 25 sources were already integrated into it, and any

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14:13 1 generation expansion planning.  
 2 Now, this kind of consideration would have been in  
 3 the minds of the Treaty's drafters in 1960. We've  
 4 already started touching on some of these issues  
 5 already. Kashmir at that time was isolated and remote.  
 6 Rather than having a unified grid, it would have been  
 7 broken into small local power systems in which  
 8 an individual HEP may have been the only power source.  
 9 Now, today, this kind of consideration is less  
 10 important. As I think Professor Minear rightly  
 11 identified, Indian-Administered Kashmir, including the  
 12 generating potential of the entire Western Rivers from  
 13 India's perspective, has been plugged into the main  
 14 Indian power grid, and specifically the Northern Region.  
 15 Now, that grid is a fully integrated modern power system  
 16 with over 137,000 MW in capacity, into which a variety  
 17 of generating sources feed: thermal, nuclear, solar,  
 18 other renewables, the whole package.  
 19 It is difficult to conceive of a HEP that could, in  
 20 and of itself, overwhelm such a power system, and so  
 21 from that standpoint, a HEP of any installed capacity  
 22 would be realistic, well-founded and defensible.  
 23 Now, the load curve is of far greater significance  
 24 in determining the HEP's anticipated load, because, as  
 25 I said, it tells the HEP when demand is greatest, and

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14:15 1 therefore when it should be producing. But it also  
 2 tells the HEP when demand is low, and therefore when the  
 3 power system can do without the plant's contribution.  
 4 When demand is low, the HEP can store water in its  
 5 operating pool as pondage. When demand is high, it can  
 6 use that pondage to increase its generating potential  
 7 above that which the river could provide with its  
 8 natural flow.  
 9 An anticipated load that meets the shape of the load  
 10 curve in this respect will be realistic, well-founded  
 11 and defensible, because it reflects how the HEP will  
 12 actually be operated.  
 13 But this takes me back to the question of "Which  
 14 load curve?" And that's defined, in Pakistan's  
 15 submission, by the purpose for which we are looking at  
 16 this, which is ultimately to determine maximum pondage  
 17 under paragraph 8(c).  
 18 Now, given that a run-of-river HEP is running in  
 19 baseload mode in the wet season, and thus not using  
 20 pondage, there is very little point in using  
 21 a wet-season load curve for this exercise. Only  
 22 a dry-season load curve makes sense, and Mr Rae will  
 23 address you further on how one might be produced for our  
 24 purposes.  
 25 (Slide 15) Now, what I've just said, however, is

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14:16 1 only the start of the process. When using a dry-season  
 2 load curve to determine anticipated load, and therefore  
 3 the requirements of pondage, a number of other factors  
 4 must be taken into account if the final result is to  
 5 actually reflect real-world use, how the plant is  
 6 actually going to be operated, as the Court has said.  
 7 Now, again, I hope to take these quickly. There's  
 8 four of them, and I list them on the slide: we have load  
 9 type, load duration, load frequency and turbine  
 10 operation.  
 11 (Slide 16) First, we've got our type of loading.  
 12 There are two broad schools. First, we have unit  
 13 loading, in which the HEP does whatever the power system  
 14 is doing minute to minute, always producing power, but  
 15 at a capacity determined by demand at the particular  
 16 moment. And second, we have block loading, in which the  
 17 HEP is still paying attention to what the power system  
 18 is doing, but is producing only during periods of higher  
 19 demand, and storing for the remainder.  
 20 Now, while unit loading may have been more  
 21 appropriate in the kind of small regional power system  
 22 that would have been common in Kashmir when the Treaty  
 23 was concluded, the connection of Indian-Administered  
 24 Kashmir to the grid of the Northern Region, and thence  
 25 to the national grid of India, more than justifies block

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14:17 1 loading, which will produce a larger pondage than unit  
 2 loading because the HEP can be zero-loaded.  
 3 (Slide 17) Now, second, we have the duration of each  
 4 block of power production. If this is to be realistic,  
 5 well-founded and defensible, it must be for a sufficient  
 6 duration that can actually be used by the grid operator  
 7 to meet demand. And that's essentially determined by  
 8 what the central dispatch needs to meet dry-season  
 9 periods of high demand.  
 10 So let's assume a power system like our sample, with  
 11 two peaks per day. In those circumstances, the grid  
 12 operator may need the HEP to be online to meet just one  
 13 of those peaks, in the morning or in the afternoon.  
 14 Each of these lasts for several hours, requiring the HEP  
 15 to be producing for at least four hours a day if it is  
 16 to make a meaningful contribution to meeting that  
 17 demand.  
 18 Now, here's a useful opportunity for me to come back  
 19 and answer one of the questions that the Chairman asked  
 20 Professor Webb, which is: does Pakistan have any  
 21 objection to an Indian HEP being used as a peaking plant  
 22 in these circumstances? And the straightforward answer  
 23 to that is: no, provided that such a use would be  
 24 realistic, well-founded and defensible; that is to say,  
 25 how the plant will actually be operated in real life.

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14:18 1 Because of course a run-of-river HEP with pondage  
 2 doesn't necessarily need and may not in fact be  
 3 desirable to use as a peak plant. You may wish to use  
 4 it instead to provide intermediate load -- that's  
 5 essentially demand whenever the baseload is exceeded --  
 6 which may lead to it producing for 8 to 14 hours a day.  
 7 So if we look at the Treaty, for example, there's no  
 8 sort of underlying assumption in there as to how the HEP  
 9 is going to be used during the dry season. It doesn't  
 10 say, "You will use your HEP as a peaking plant", or,  
 11 "You will use it as an intermediate plant". It's driven  
 12 by what India needs it to do in the grid at a particular  
 13 period of time, which is, as I said, driven by the needs  
 14 of the power system. In fact it's quite common for  
 15 a run-of-river HEP with pondage to be used to provide  
 16 intermediate power as opposed to peaking power,  
 17 depending on the mix in the system.  
 18 Now, depending on the load curve in question, either  
 19 of these, peak power or intermediate power, would be  
 20 a realistic, well-founded and defensible framework in  
 21 which to fit the plant on your load curve. But what  
 22 isn't realistic, well-founded and defensible is a plant  
 23 that's only producing for one or two hours a day.  
 24 Let's just take a simple hypothetical. One can  
 25 imagine an overworked dispatcher, charged with meeting

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14:20 1 demand for a power system with a baseload of 50,000 MW  
 2 and a peak demand of 100,000 MW. At 6.00 am, when her  
 3 200-odd power plants report in to get their marching  
 4 orders for the day, one of them says, "Hi, I'm a 400 MW  
 5 hydro plant with pondage. I like to store for 23 hours  
 6 at a time and I can give you 1 hour of production at my  
 7 installed capacity from 1.20 to 2.20 pm". That plant  
 8 operator would be laughed at and they'd be told to get  
 9 with the programme.  
 10 Given the grid's operators need to coordinate the  
 11 startup and shutdown of large numbers of power plants  
 12 throughout the day, along with load variations, the  
 13 400 MW HEP's proposed contribution would be essentially  
 14 useless. It would be like a musician in a symphony  
 15 whose job is to play a single note on the triangle,  
 16 while the rest of the orchestra gets on with producing  
 17 the actual music.  
 18 Indeed, from a certain point of view, the HEP is  
 19 even worse than the triangle player, because the other  
 20 power plants will need to be online to take up the  
 21 slack, affecting overall system investment.  
 22 (Slide 18) Third, we have the question of load  
 23 frequency, and by this I mean day-to-day variation in  
 24 power generation.  
 25 Now, if we go back to our sample load curve, we can

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14:21 1 see that demand varies within the power system.  
 2 Weekends, in green, have low demand, and weekdays, in  
 3 red, have high demand.  
 4 A run-of-river HEP with pondage in such conditions  
 5 would be justified in producing less over the low-demand  
 6 weekend; that is, using it to store water as pondage.  
 7 And it would be also justified in using that pondage  
 8 during the high-demand week to boost power production.  
 9 But -- and this is the important bit -- every power  
 10 system is different. The programme I just described  
 11 would be perfectly realistic, well-founded and  
 12 defensible in a power system like the one on the slide.  
 13 It would not at all be justified in a power system that  
 14 does not show any change in demand between the weekend  
 15 and the weekday.  
 16 Such a power system -- and Mr Rae will direct you  
 17 further on this -- would be required to have the same  
 18 operating pattern each day to meet the consistent demand  
 19 on both weekdays and weekends. Were a HEP within that  
 20 system to insist on storing on weekends, it would be not  
 21 be realistic, well-founded and defensible, again because  
 22 other generating facilities would need to take up the  
 23 slack that it left. The result would be increased costs  
 24 in investment in grid capacity, by which I mean you  
 25 would have to construct other power plants to meet the

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14:23 1 demand at the weekend that still exists while the HEP is  
 2 in storage mode.  
 3 (Slide 19) The fourth factor is turbine operation.  
 4 This has less to do with the demand on the power system  
 5 and more to do with how a HEP may be expected to operate  
 6 within that power system.  
 7 Turbines in the dry season do not operate in on/off  
 8 mode; that is, producing either at 100% of their  
 9 installed capacity or not all. When commencing power  
 10 production, the turbine operator will typically ramp up  
 11 production over the course of a certain number of  
 12 minutes to reach the desired capacity, which will then  
 13 be held for the duration of the block. After the block  
 14 concludes, the operator will then ramp down production  
 15 over a similar timeframe.  
 16 A further question is the capacity at which that  
 17 turbine is producing. Again, an anticipated load that  
 18 assumes production at the full rating of that turbine  
 19 may not be realistic, well-founded and defensible.  
 20 As I earlier noted, the HEP's installed capacity is  
 21 fixed by reference to the wet-season flow, when fuel is  
 22 plentiful. In the dry season, when fuel is scarce, it  
 23 may be -- and indeed, will very probably be -- desirable  
 24 to run the HEP at less than its installed capacity, by  
 25 reference to what is called by engineers the "best

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14:24 1 efficiency point" or "BEP" of the turbines. And you  
 2 heard from Professor Webb earlier today that in some of  
 3 India's early calculations, they seem to have taken this  
 4 point into account, but abandoned it later on.  
 5 Now, the reason why you would want to do this as  
 6 a plant operator is that it will allow for an increase  
 7 in generating hours from the same reduced flow volume,  
 8 resulting in a net increase in the amount of energy that  
 9 the HEP is able to produce on a given day.  
 10 And the final point in this respect is turbine  
 11 maintenance. As we have seen together on the site  
 12 visit, a turbine is an immense piece of industrial  
 13 equipment that is technically quite complex, subjected  
 14 to incredible physical stress, and is very expensive to  
 15 replace.  
 16 It follows that these turbines will need to be taken  
 17 offline for maintenance, with most guidelines stating  
 18 that this should occur once every 12 months. And given  
 19 that during the wet season, all turbines will be  
 20 required for the production of baseload power, it's  
 21 better to take that turbine offline and do your  
 22 maintenance during the dry season. It's therefore  
 23 normal for HEP operation during the dry season to take  
 24 account at least of one turbine being offline at any  
 25 given time, which will of course impact the anticipated

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14:25 1 load on the plant.  
 2 Now, earlier today, the Chair asked Professor Webb  
 3 how we know that the load curves being projected by  
 4 India are hypothetical. And I can give a quick answer  
 5 now, which may be subject to some elaboration later on.  
 6 The short answer is that Pakistan can tell by  
 7 looking at the storage and discharge schedule provided  
 8 by India as part of its calculation. That schedule very  
 9 often does not reflect the kind of operational paradigm  
 10 that I just described: things like the plant being run  
 11 for nine hours flat in the middle of the night, where  
 12 everyone is asleep, at their installed capacity, for  
 13 example.  
 14 Now, I illustrated one of these in the First Phase  
 15 on the Merits with respect to India's storage and  
 16 discharge programme for the Kiru HEP. That was at Day 6  
 17 of the transcript, pages 91 to 99. And we can also see  
 18 echoes of the same points being made in something that  
 19 Professor Webb put on the slide, being the comments by  
 20 the PCIW at the 113th meeting of the Permanent Indus  
 21 Commission in 2017; that's P-0103.  
 22 So that's the quick answer. We may provide you with  
 23 further detail later on.  
 24 THE CHAIRMAN: Dr Miles, this may be more for Mr Rae, but  
 25 I'm wondering about some of the assertions of the kind

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14:27 1 you just made.  
 2 It's obvious that it must be hypothetical. This may  
 3 be more a question for our engineer friends, but I could  
 4 imagine a world in which a grid relies on renewable  
 5 sources of energy, such as wind, and yet the wind always  
 6 dies at nighttime, and consequently you have to turn to  
 7 other sources of energy to make up for that loss.  
 8 Why mightn't that be an explanation for the  
 9 particular obvious problem that you just identified as  
 10 demonstrating that the load curve must be hypothetical?  
 11 DR MILES: Because it's a series of factors. I mean, I gave  
 12 one example, which was: nine hours' generation capacity  
 13 in the middle of the night. But when that's combined  
 14 with other slightly more suspicious factors -- so, for  
 15 example, for the first three days of a week, producing  
 16 only one hour a day, producing absolutely nothing of any  
 17 utility whatsoever -- to the grid operator, when you  
 18 combine that with, in the middle of the week,  
 19 discharging nine hours at the installed capacity, it  
 20 stops looking like a rational mode of plant operation  
 21 and starts looking like somebody who is deliberately  
 22 storing for the first half of the week and then running  
 23 the HEP at a completely improvident rate in the middle  
 24 of the night to ensure that they can get their pondage,  
 25 their weekly inflow, out of the reservoir in time to

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14:29 1 DR MILES: Well, there's two points to be made in relation  
 2 to that.  
 3 The first one is -- and this is justified -- it's  
 4 hypothetical, right? Unless you can provide the  
 5 evidence showing why exactly you need the HEP to be run  
 6 in that particular way, it's not a well-founded,  
 7 realistic and defensible projection; it's just  
 8 an assertion on the part of India.  
 9 But if I can be slightly facetious, I mean, isn't it  
 10 remarkable that every single one of India's plants has  
 11 this highly unusual operational form of operating in the  
 12 circumstances? I mean, they all have these highly  
 13 unusual schedules where they're storing at odd hours,  
 14 they're discharging at odd hours. I think -- I might be  
 15 corrected on this -- but you sort of have to look very  
 16 carefully to see if you can find a hydro plant that  
 17 India has proposed which has what you would expect, in  
 18 terms of ordinary operation, when you compare it to the  
 19 applicable load curve.  
 20 THE CHAIRMAN: Right. Well, you can correct me if I'm  
 21 wrong: I don't think we do have before us information on  
 22 all of the electric-generating plants that India  
 23 operates. We have a limited number of hydro plants that  
 24 are run-of-river plants. And consequently, it's not  
 25 obvious to me that when one looks at the entire grid,

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14:28 1 meet the storage and discharge limits of paragraph 15.  
 2 So it's never just one thing, Mr Chairman. It's  
 3 always a multitude of factors which, while individually  
 4 they may be explicable in exactly the way you just did,  
 5 when you put them in combination, it really doesn't make  
 6 any kind of rational sense.  
 7 But Mr Rae will be able to address you further on  
 8 that.  
 9 THE CHAIRMAN: Well, just to follow up on it -- and of  
 10 course Mr Rae may be the one to address it -- but as  
 11 I understand it, there's some appreciation that these  
 12 HEPs are now operating within a system where there are  
 13 a number of different HEPs, and there's also different  
 14 sources of energy, all feeding into the grid, such that  
 15 is it not possible that one might contemplate  
 16 a particular HEP being used in a way that in isolation  
 17 might seem unusual, but in fact, when one contemplates  
 18 the possibilities within the grid on average -- where  
 19 there might be a lack of this type of energy because  
 20 there's no wind or that type of energy because there's  
 21 no sun -- that we're going to rely on the hydro plant,  
 22 this particular hydro plant, to supply the power needed  
 23 at a particular time of the week?  
 24 I'm still not quite clear on why it's obvious that  
 25 this is a hypothetical and unreasonable approach.

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14:31 1 whether regional or national, it's demonstrated that  
 2 there's something particularly unusual regarding these  
 3 plants in the grand scheme of the grid as a whole, at  
 4 least in terms as I just laid out for you.  
 5 It may be Pakistan is correct in saying that it's  
 6 obvious this is hypothetical, but I'm still struggling  
 7 a little bit to see whether there are alternative  
 8 explanations for why the plants might be operated in  
 9 a particular way.  
 10 DR MILES: Well, in that case, two points. The first one  
 11 would be: we may have to come back to Mr Rae for a bit  
 12 more of a granular description.  
 13 But the second point that I would make is: if there  
 14 is an alternative explanation, it's India's; they have  
 15 to provide one. I mean, if the Court is correct -- and  
 16 the Court must be correct, for it is the Court in the  
 17 General Issues Award -- that India bears the burden of  
 18 proof in proving that this is a realistic, well-founded,  
 19 defensible mode of HEP operation, then if there's the  
 20 absence of an explanation, there's only one outcome,  
 21 which is that it's not.  
 22 THE CHAIRMAN: So your understanding is [India's]  
 23 hydroelectric run-of-river plants are operated in the  
 24 manner that you're describing to us here today, that  
 25 information is available to you; that information could

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14:32 1 indicate that, with respect to either a regional or  
 2 a national grid, the plants are all operating in  
 3 a particular type of sequence, following a particular  
 4 load curve? I don't know if we have that information  
 5 before us, but that would seem relevant in trying to  
 6 understand whether there are differentials among  
 7 different plants.  
 8 DR MILES: Certainly that's not information that's available  
 9 to me, but we'll come back to you on that.  
 10 PROFESSOR BUYTAERT: Thank you, Mr Chairman. Just a quick  
 11 follow-up.  
 12 In fact, the majority of plants -- or at least a lot  
 13 of plants that India has built -- did not require any  
 14 pondage. So clearly they haven't gamed the load curve  
 15 to maximise pondage, even though technically I guess  
 16 they could have. Doesn't that go a bit against your  
 17 claim that all plants showed this unusual load curve?  
 18 DR MILES: Sorry, you're quite right, Professor Buytaert.  
 19 "All plants with pondage" would be the correct  
 20 statement. Obviously, if there's no pondage, there's no  
 21 way to game the load curve, because there is no load  
 22 curve that's applicable in the circumstances. It's  
 23 producing whatever is possible given the flow of the  
 24 river at a particular time.  
 25 So yes, that's an important clarification.

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14:33 1 PROFESSOR BUYTAERT: So it does mean that India could have  
 2 built pondage on those plants, including a load curve.  
 3 They clearly decided not to do that.  
 4 DR MILES: Well, I mean, I don't know what the explanation  
 5 for every one of those individual plants may be. It may  
 6 be that the site in question didn't allow for pondage,  
 7 it may be that the economic model under which the plant  
 8 was built did not require pondage. All we know is that  
 9 they simply did not propose pondage for these plants.  
 10 But what we do see is that, particularly with the  
 11 larger plants that India is proposing, they do come with  
 12 quite generous allocations of pondage. So we're  
 13 thinking about Dul Hasti, we're thinking about Baglihar,  
 14 Kiru, Kwar, plants of that character. The only large  
 15 one that I can think of that doesn't have pondage is  
 16 probably Salal. But of course that's the Chenab below  
 17 Ramban, in circumstances where the operational rules  
 18 don't allow for large amounts of pondage because of  
 19 the daily and weekly storage limits.  
 20 So again, just to push back on your presumption,  
 21 it may be that India is "gaming the system" -- to use  
 22 your term, not mine -- with respect to these larger  
 23 plants, which are going to have a large impact  
 24 downstream on Pakistan.  
 25 PROFESSOR BUYTAERT: Thank you.

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14:34 1 DR MILES: So that's what I wanted to say about the broad  
 2 parameters of how India should be calculating  
 3 a realistic, well-founded and defensible projection of  
 4 installed capacity and anticipated load for a proposed  
 5 HEP under the framework set out by the Court.  
 6 (Slide 20) With that in hand, I turn now to plug  
 7 that analysis more directly into the legal framework for  
 8 the calculation of maximum pondage set out by the Court  
 9 in the General Issues Award.  
 10 (Slide 21) On the slide, we have the considerations  
 11 set down by the Court in part O of the dispositif. As  
 12 we know from the Clarification Decision, this  
 13 formulation must be read against the background of the  
 14 Court's reasoning in Part 11 of the General Issues  
 15 Award; and in particular, the requirement that the  
 16 projection of installed capacity and anticipated load by  
 17 India must be "realistic, well-founded, and defensible",  
 18 which includes within it the Court's other elaborations  
 19 in paragraphs 742 and 743 that we looked at earlier: the  
 20 projection must be generated with an eye as to how the  
 21 plant will "actually be operated", and cannot be  
 22 hypothesised in a manner that will increase amount of  
 23 pondage on offer.  
 24 (Slide 22) When we put these elements together,  
 25 we get the process that we see on the slide.

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14:36 1 First, we must calculate the MMD at the relevant HEP  
 2 site in accordance with the formula set out at  
 3 paragraph 2(i) of Annexure D.  
 4 Second, we must assume that the river at the HEP  
 5 site is flowing consistently at the MMD over the daily  
 6 and weekly time periods set out in paragraph 16 of  
 7 Annexure D.  
 8 Third, by reference to a realistic, well-founded and  
 9 defensible projection of the plant's anticipated load  
 10 and installed capacity, we schedule that MMD inflow in  
 11 order to meet "fluctuations in the discharge of the  
 12 turbines arising from variations in the daily and weekly  
 13 loads of the Plant" within the meaning of  
 14 paragraph 2(c).  
 15 Fourth, we check the schedule so produced to ensure  
 16 that it complies with the relevant daily and week limits  
 17 of paragraph 15. If the schedule exceeds those limits,  
 18 we moderate it such that it remains within the relevant  
 19 limits.  
 20 Fifth, we select the largest amount of pondage  
 21 required over the week to meet the  
 22 paragraph 15-compliant schedule and fix that as  
 23 the pondage "required for Firm Power".  
 24 And sixth, then we double that pondage "required for  
 25 Firm Power" to fix the maximum size of the operating

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14:37 1 pool, in keeping with paragraph 8(c).  
 2 As we can see, installed capacity and anticipated  
 3 load are to be taken into account at step 3 of our  
 4 analysis, and the analysis that I took you through in  
 5 the second section of this presentation is geared  
 6 towards fleshing out that step just a little bit more.  
 7 (Slide 23) Now, in Pakistan's submission, if  
 8 the Court accepts that analysis, then the following  
 9 interpretive assumptions must be built into step 3.  
 10 First, the installed capacity and anticipated load  
 11 of the HEP must be calculated on the basis of  
 12 a realistic, well-founded and defensible projection of  
 13 those elements.  
 14 Second, what is considered to be a well-founded,  
 15 realistic and defensible projection in this context must  
 16 take account of several other factors on which the Court  
 17 shone a light in the General Issues Award. In  
 18 particular, the projections must correspond to how  
 19 the HEP will actually be operated once constructed;  
 20 it cannot be hypothesised in a manner that serves to  
 21 inflate maximum pondage; and it must be established by  
 22 India on the basis of material provided to Pakistan in  
 23 the discharge of its obligations under paragraph 9 and  
 24 Appendix II of Annexure D.  
 25 Third, the question of how the HEP will actually be

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14:38 1 operated in this context is to be determined by  
 2 reference to the hydrology of the HEP site and the needs  
 3 of the power system to which the HEP will be expected to  
 4 contribute in the dry season, when pondage will actually  
 5 be required.  
 6 Fourth, the needs of the power system will be  
 7 determined by reference to a load curve representative  
 8 of typical demand during the dry season. And again,  
 9 Mr Rae will set out how an ordinary power planning  
 10 analysis of the Northern Region Grid would generate  
 11 a useful and accurate load curve for these purposes.  
 12 Fifth, when determining the capacity utilised and  
 13 anticipated load on the HEP in light of that load curve,  
 14 account should be taken of, among other things: the  
 15 distribution of demand as between weekends and weekdays  
 16 within the power system; the need for the HEP to make  
 17 a meaningful contribution to the power system on a daily  
 18 and weekly basis at times of peak demand; the need for  
 19 realistic daily dispatch schedules considering the  
 20 operation of the HEP within the overall system; and the  
 21 operation of the HEP turbines, including the need for  
 22 proper ramp-up and ramp-down time, operation at the best  
 23 efficiency point, and maintenance.  
 24 Now, the Court will recall that one of the concerns  
 25 which Sir Daniel mentioned in opening today, when asking

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14:40 1 for the Clarification Decision and again in asking for  
 2 this Second Phase on the Merits, one of the concerns  
 3 that was expressed was that leaving things as they stood  
 4 in the General Issues Award, in particular the  
 5 considerable part of the interpretive edifice resting on  
 6 the phrase "realistic, well-founded, and defensible",  
 7 would be a recipe for propagating disputes on pondage  
 8 between Pakistan and India, rather than resolving them.  
 9 In Pakistan's submission, if something like this  
 10 analysis is adopted by the Court as an elaboration or  
 11 expansion of the existing language of part O of the  
 12 dispositif, then it will go a long way towards injecting  
 13 appropriate certainty into the Court's formulation.  
 14 India will be able to have the pondage it requires for  
 15 each new HEP in view of how the plant will actually be  
 16 operated; and Pakistan will be able to test whether that  
 17 pondage is actually required by reference to a defined  
 18 list of factors.  
 19 PROFESSOR MINEAR: Dr Miles --  
 20 DR MILES: Yes.  
 21 PROFESSOR MINEAR: -- if India does follow through the  
 22 approach that you described and in good faith designs  
 23 the pondage to meet what they anticipate to be the  
 24 actual operation, but things change in the future and  
 25 the plant is operated differently, do you agree that

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14:41 1 that would not lead to a violation of the Treaty, simply  
 2 if they change their operation even though they have  
 3 fixed the pondage differently at the design phase?  
 4 DR MILES: I'll answer with a certain amount of caution  
 5 there, because I think I may have to seek consultation  
 6 with colleagues on that matter. But at a very, very  
 7 high level, and without binding Pakistan to anything in  
 8 particular, I think if India demonstrates as part of its  
 9 projection that they anticipate that the grid or the  
 10 load curve is going to shift, then that could well be  
 11 appropriate under the terms of the Treaty and under  
 12 the framework set out. But again, this is India's case  
 13 to prove, in the circumstances. And as we saw by  
 14 looking at the reference to Creager and Justin, load  
 15 curves tend to be pretty consistent on a year-to-year  
 16 basis.  
 17 So again, speaking hypothetically, as you sort of  
 18 invited me to do, I would say that it would be  
 19 a remarkable situation if India were to say: well, in  
 20 20 years' time, we imagine a complete sea-change to the  
 21 grid, and on that basis we need to now model our pondage  
 22 based on what's going to happen for the next 20 years,  
 23 but the 20 years beyond that. It would be quite  
 24 a dramatic shift in the nature of the load curve, in my  
 25 submission.

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14:42 1 But again, I'll seek further consultations with  
 2 colleagues and get back to you with a more granular  
 3 answer.  
 4 PROFESSOR MINEAR: Thank you.  
 5 DR MILES: (Slide 24) Now, that draws a line for now under  
 6 installed capacity and anticipated load.  
 7 In the final part of these submissions, I'm going to  
 8 focus on two other relevant elements in the framework  
 9 set down in the General Issues Award which arise under  
 10 paragraph 2.3.7 of PO17. The first has already been  
 11 included in the Court's analysis, and that is  
 12 paragraph 15 of Annexure D. The second, however, has  
 13 not, and that's the concept of minimum environmental  
 14 flow, or "e-flow" as it's commonly called. I'll address  
 15 each in turn.  
 16 (Slide 25) Let's start with paragraph 15. That  
 17 provision is obviously well known to the Court, and so  
 18 we don't need to look at it again. But as the Court  
 19 noted at paragraph 678 of the General Issues Award:  
 20 "... [it] plays a crucial role in ensuring that  
 21 India meets its obligation under Article III to 'let  
 22 flow' the waters of the Western Rivers, subject to the  
 23 exceptions noted therein. Paragraph 15 generally  
 24 requires that: ... the same volume of water received in  
 25 the river upstream of the plant in a week must be

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14:45 1 "Absent the daily and weekly water delivery  
 2 requirements contained in Paragraph 15, India would have  
 3 much greater latitude to accumulate storage to meet peak  
 4 load demands, contrary to the object and purpose of  
 5 the Treaty."  
 6 So far, so good. Although the model for the  
 7 calculation of pondage put forward by Pakistan in the  
 8 First Phase on the Merits maintained a strict separation  
 9 between design and operation, if operational  
 10 requirements -- that is, how the HEP will actually be  
 11 operated -- are to be a key determinant in the  
 12 calculation of pondage under paragraph 8(c), then  
 13 paragraph 15 must form part of the exercise.  
 14 But Pakistan raises paragraph 15 in the context of  
 15 this Second Phase on the Merits to make a point, which  
 16 is that just because India is entitled to a particular  
 17 weekly and daily flow manipulation under paragraph 15  
 18 does not mean that it is entitled to a projection of  
 19 anticipated load that stretches the limits of  
 20 paragraph 15 to their breaking point on each and every  
 21 occasion. As the Court has made clear, paragraph 15 is  
 22 a limit.  
 23 Now, put another way, if the HEP will not, in the  
 24 real world, actually be operated in such a way that the  
 25 limits of paragraph 15 will be met, then India is not

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14:43 1 released back into the river below the plant in the same  
 2 week; and ... the volume of water delivered into the  
 3 river in any given day generally shall not be less than  
 4 30 per cent or more than 130 per cent of the volume  
 5 received above the plant during the same 24-hour  
 6 period."  
 7 Of course, paragraph 15(i) and (ii) set different  
 8 daily limits for plants on the Chenab, with this further  
 9 variation depending on whether the HEP is above or below  
 10 Ramban.  
 11 (Slide 26) Now, paragraph 15 is mentioned nowhere in  
 12 paragraph 8(c). Nonetheless, and bearing in mind the  
 13 Kishenganga Court's injunction in its partial award with  
 14 respect to paragraph 15(iii) that HEP design and  
 15 operation cannot easily be separated, the Court held at  
 16 paragraph 681, on the slide, that paragraph 15 was  
 17 therefore a "vital element for the methodology for  
 18 calculating maximum Pondage under paragraph 8(c)".  
 19 It went on to note that the inclusion in  
 20 paragraph 15 as a limitation on pondage:  
 21 "... serves as a turbine discharge constraint that  
 22 must be considered in determining how to manager water  
 23 storage to meet the HEP's daily and weekly load  
 24 conditions."  
 25 By the same token, it also observed that:

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14:46 1 allowed to alter its anticipated load in such a way as  
 2 to avoid, so to speak, leaving its money on the table,  
 3 essentially increasing its pondage. If India doesn't  
 4 need the money, it stays where it is. To permit  
 5 anything else would be to cut across the Court's  
 6 directive, expressed in paragraph 743 of the General  
 7 Issues Award, that anticipated load may not be  
 8 hypothesised in a manner "that serves to inflate  
 9 the amount of maximum pondage".  
 10 (Slide 27) Now, why Pakistan mentions this is in  
 11 order to prevent further disorder from developing  
 12 between the Parties with respect to pondage. And it  
 13 does so because India, although it includes paragraph 15  
 14 in its methodology for the calculation of pondage, seems  
 15 to have rather a different understanding to the Court of  
 16 how it operates.  
 17 As you've heard from Professor Webb, and as you will  
 18 have seen from Pakistan's Memorial, India has  
 19 historically seen paragraph 15 as an entitlement in  
 20 the calculation of pondage, insisting on being allowed  
 21 to use paragraph 15 to essentially determine the  
 22 anticipated load on the HEP. We see this from P0082,  
 23 now on the slide, which is a letter sent from India's  
 24 Commissioner to Pakistan's Commissioner on  
 25 11 September 2013 concerning the RHEP. It says:

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14:47 1 "... the operation rules in Paragraph 15 allow India  
 2 to hold or release water [at the RHEP site] within  
 3 a band of 50% to 130% within a period of seven days.  
 4 Therefore, there can be no objection to the Plant  
 5 generating power in any pattern, including peaking, [as]  
 6 long as it releases water in accordance with  
 7 Paragraph 15."  
 8 Well, that's not right, not on the Court's  
 9 methodology. If the Court says that anticipated load is  
 10 to be set in accordance with how the plant is actually  
 11 to be operated, and the way in which the plant will  
 12 actually be operated won't test the limits of  
 13 paragraph 15, then India insisting on its full  
 14 paragraph 15 "entitlement" -- and the Court will note  
 15 the problematising air quotes -- becomes profoundly  
 16 objectionable. India will have taken something that the  
 17 Court intended and defined as a limit, and will instead  
 18 have turned it into a device to increase its pondage.  
 19 (Slide 28) Now, as to what the Court can do about  
 20 this: in Pakistan's submission, very little. Part O of  
 21 the dispositif of the General Issues Award makes clear  
 22 that the Court intended when it incorporated  
 23 paragraph 15 into the analysis, and that is: it is  
 24 a limit to be abided by.  
 25 This language does not indicate, contrary to India's

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14:49 1 methodology, an entitlement to the reservoir operation  
 2 that paragraph 15 permits unless justified by the  
 3 anticipated load on the plant, which in turn looks  
 4 predominantly at the requirements of the relevant power  
 5 system.  
 6 Where the anticipated load would suggest that the  
 7 limit of paragraph 15 must be exceeded -- and we can  
 8 think about universes in which that would occur -- then  
 9 the Court's methodology requires that India constrain  
 10 its ambition and shape the anticipated load by reference  
 11 to the applicable daily and weekly limits of  
 12 paragraph 15.  
 13 In this sense, the formulation in part O of the  
 14 dispositif is entirely fit for purpose. All that  
 15 Pakistan requests from the Court is clarity that the  
 16 description I have just given is correct. If that  
 17 clarification is given, Pakistan is hopeful that further  
 18 difficulties maybe avoided in the Commission, as there  
 19 was no doubt that the Court is excluding as legitimate  
 20 the kind of approach we looked at in P-0082.  
 21 That's all I wanted to say on paragraph 15. I'd  
 22 like to turn finally to the somewhat new topic, which is  
 23 of course the topic of e-flow.  
 24 Now, as you'll have seen in paragraph 3E.2 of  
 25 Pakistan's Memorial, and heard from Sir Daniel, Pakistan

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14:50 1 is also requesting the Court, under paragraph 2.3.7 of  
 2 PO17, to consider extending the same treatment as it  
 3 extended to paragraph 15 in the calculation of pondage  
 4 under paragraph 8(c) to e-flow.  
 5 (Slide 29) Now, India's obligation to allow for  
 6 e-flow was delineated in the Kishenganga partial award  
 7 (Exhibit PLA-0003).  
 8 By way of high-level context, the e-flow question  
 9 arose in the context of the KHEP, which, as the Court  
 10 knows, was and is a diversion project under  
 11 paragraph 15(iii) of Annexure D, diverting the  
 12 Kishenganga into the Bonar Nallah and then, via  
 13 Wular Lake, into the Jhelum Main.  
 14 Pakistan objected to this for a multitude of  
 15 reasons, but one of these was that in the dry season,  
 16 the KHEP diversion would leave the Kishenganga, and  
 17 thence the Neelum, dry. Of course the Treaty says  
 18 nothing about this expressly, which compelled Pakistan  
 19 to argue that some minimum flow obligation on India had  
 20 to be implied, as an additional constraint on India.  
 21 And the Court agreed. On this basis, at  
 22 paragraph 541, on the slide, it recognised that India's  
 23 right to divert waters under the Treaty is not  
 24 unlimited, in the sense that customary international law  
 25 imposes on states "a duty to prevent, or at least

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14:52 1 mitigate' significant harm to the environment when  
 2 pursuing large-scale construction activities", drawing  
 3 on the finding of the tribunal in the Iron Rhine  
 4 arbitration.  
 5 (Slide 30) And then, at paragraph 452, it also  
 6 considered that:  
 7 "It is therefore incumbent upon this Court to  
 8 interpret and apply this 1960 Treaty in light of the  
 9 customary international principles for the protection of  
 10 the environment in force today."  
 11 (Slide 31) And finally, at 455, it recorded that the  
 12 Parties were in agreement that the [maintenance] of  
 13 a minimum flow obligation was required "in response to  
 14 considerations of environmental protection".  
 15 That's the partial award. In the final award, the  
 16 Kishenganga Court consolidated and applied this  
 17 reasoning in order to determine the precise quantum of  
 18 e-flow that India was required to provide for the KHEP;  
 19 and in so doing, it clarified and generalised what  
 20 it was saying in the partial award.  
 21 (Slide 32) In particular, at paragraph 112  
 22 it reasoned:  
 23 "As the Court held in its Partial Award, 'States  
 24 have "a duty to prevent, or at least mitigate"  
 25 significant harm to the environment when pursuing

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14:53 1 large-scale construction activities.' In light of this  
 2 duty, the Court has no difficulty concluding that the  
 3 requirement of an environmental flow (without prejudice  
 4 to the level of such flow) is necessary in the  
 5 application of the Treaty."  
 6 The Court then continued:  
 7 "At the same time, the Court does not consider it  
 8 appropriate, and certainly not 'necessary,' for it to  
 9 adopt a precautionary approach and assume the role of  
 10 policymaker in determining the balance between  
 11 acceptable environmental change and other priorities, or  
 12 to permit environmental considerations to override the  
 13 balance of other rights and obligations expressly  
 14 identified in the Treaty -- in particular the  
 15 entitlement of India to divert the waters of  
 16 a tributary ... The Court's authority is more limited  
 17 and extends only to mitigating significant harm."  
 18 Now, drawing the threads of this together, what the  
 19 Kishenganga Court has done is tell the Parties that in  
 20 operating HEP projects on the Western Rivers, and where  
 21 necessary to prevent significant harm to the  
 22 environment, India has an obligation to provide for  
 23 a constant e-flow, irrespective of the impact that flow  
 24 will have on the power generation for those HEPs. And  
 25 in the case of the KHEP, the Kishenganga Court fixed

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14:55 1 constraint that must be considered in determining how to  
 2 manage water storage to meet the HEP's daily and weekly  
 3 load conditions."  
 4 In Pakistan's submission, this logic applies equally  
 5 to e-flow, which is also not mentioned in  
 6 paragraph 8(c), but which is nonetheless a turbine  
 7 discharge constraint on India that must be met in  
 8 considering how to manage water storage, particularly  
 9 during the dry season.  
 10 Simply put, if paragraph 15 is to be taken into  
 11 account in the calculation of pondage under  
 12 paragraph 8(c), then the same logic necessarily and  
 13 unavoidably must follow in the case of e-flow. In other  
 14 words, it reflects how the plant will actually be  
 15 operated.  
 16 (Slide 35) And it appears, to a limited extent  
 17 at least, that India agrees, mirroring its agreement  
 18 concerning e-flow for the KHEP before the Kishenganga  
 19 Court. In the three new HEPs with pondage that it has  
 20 proposed to Pakistan in the wake of the Kishenganga  
 21 arbitration -- the RHEP, Kiru and Kwar -- it has  
 22 conditioned its pondage by reference to e-flow. The  
 23 exhibit references are on the slide, but in short, Kiru  
 24 has been designed to accommodate an e-flow of  
 25 16.33 cumecs, Kwar has an e-flow of 16.49 cumecs and

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14:54 1 that obligation at 9 cumecs.  
 2 (Slide 33) Now, in this sense, the obligation on  
 3 India to provide for e-flow is precisely the same as  
 4 paragraph 15 as interpreted by the Court in the General  
 5 Issues Award. Although it is an operational rule, as  
 6 this Court pointed out by reference to the Kishenganga  
 7 partial award at paragraph 680 of the General Issues  
 8 Award, the "continuum of design, construction and  
 9 operation ... cannot properly be sealed into watertight  
 10 compartments".  
 11 By the same token, the Court observed also:  
 12 "In this instance, both design and operational  
 13 provisions serve to constrain the volume of maximum  
 14 Pondage at the HEP. Indeed, India's ability to time the  
 15 retention or release of water -- the central concern of  
 16 Paragraph 15 -- turns on the volume of water able to be  
 17 temporarily stored as Pondage pursuant to  
 18 Paragraph 8(c)."  
 19 (Slide 34) Just to round off that line of reasoning,  
 20 we see that Court has already declared at paragraph 681  
 21 that:  
 22 "... although Paragraph 8(c) does not [refer]  
 23 expressly ... to Paragraph 15, the latter is a vital  
 24 element for the methodology for calculating 'maximum  
 25 Pondage', for it serves as a turbine discharge

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14:56 1 the RHEP has an e-flow of 33.3 cumecs.  
 2 Obviously, and regrettably, India is not here to  
 3 explain itself. But on the basis of this information,  
 4 it appears it might be common ground that e-flow is now  
 5 as much a part of the pondage calculation as  
 6 paragraph 15 is. And this, together with the analysis  
 7 of the Kishenganga partial and final awards, and with  
 8 the relevant parts of the Court's General Issues Award,  
 9 compels the introduction of e-flow to the Court's  
 10 calculation methodology.  
 11 PROFESSOR MINEAR: Dr Miles --  
 12 DR MILES: Yes.  
 13 PROFESSOR MINEAR: -- if I could interrupt you for a second.  
 14 DR MILES: Please.  
 15 PROFESSOR MINEAR: Could it be that India is simply calling  
 16 the paragraph 15 releases e-flow? Because they seem to  
 17 match exactly with what is needed to meet the  
 18 paragraph 15 requirements.  
 19 DR MILES: So the reason why we consider it might be e-flow  
 20 is because it's consistent. So obviously there is no  
 21 sort of regularity with paragraph 15: as long as you're  
 22 meeting your daily storage and discharge limit, it's  
 23 perfectly fine. But the fact that they have this  
 24 consistent flow throughout the entire day is more  
 25 consistent, at least in our submission, with how e-flow

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14:57 1 is ordinarily understood, rather than paragraph 15.  
 2 PROFESSOR MINEAR: Thank you.  
 3 DR MILES: Self-evidently, this argument was not open to  
 4 Pakistan under its previous methodology for the  
 5 calculation of pondage, which kept design and  
 6 operational criteria separate. But now that the Court  
 7 has held that this was misguided, it is free to advance  
 8 this position, and so does.  
 9 (Slide 36) Now, as to where the e-flow obligation  
 10 fits in the overall scheme of things, Pakistan submits  
 11 that it would sit alongside its fellow operational rule  
 12 in paragraph 15, reflecting how the HEP would actually  
 13 be operated. After fixing anticipated load, India must  
 14 account for e-flow in its scheduling of weekly inflow,  
 15 before selecting the pondage required for firm power.  
 16 Now, as to the methodology for fixing e-flow,  
 17 Sir Daniel has already explained Pakistan's position.  
 18 But obviously, each HEP site will be based on  
 19 a different hydrology and will therefore have  
 20 a different e-flow.  
 21 Pakistan does not, at this hearing, ask the Court to  
 22 specify a methodology for e-flow calculation under the  
 23 Treaty, but it does ask that the Court's approach to  
 24 paragraph 8(c) be expanded to account for this vital  
 25 operational restriction, one that India seems already to

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14:59 1 be taking into account in the calculation of pondage.  
 2 Now, I am conscious that I am standing between the  
 3 Court and Mr Rae, who is very well equipped to describe  
 4 how the legal framework I have just set out could be  
 5 operationalised as a matter of engineering and how it  
 6 affects the calculation of pondage under paragraph 8(c)  
 7 in a numerical acceptance. So unless I can assist the  
 8 Court further, those are my submissions in the first  
 9 round.  
 10 PROFESSOR MINEAR: Dr Miles, can we go back to page 27?  
 11 DR MILES: We may, yes.  
 12 PROFESSOR MINEAR: We have the highlighted language here  
 13 concerning India's position (P-0082, paragraph 9), where  
 14 India states:  
 15 "... there can be no objection to the Plant  
 16 generating power in any pattern, including peaking, so  
 17 long as it releases water in accordance with  
 18 Paragraph 15."  
 19 If India says that, "This is how we're actually  
 20 going to generate power, even though it's inconsistent  
 21 with an applicable load curve", is that permissible  
 22 under the Treaty?  
 23 DR MILES: Not on the logic that the Court deployed in the  
 24 General Issues Award. I mean, it's not a realistic,  
 25 well-founded and defensible projection of anticipated

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15:00 1 load, in particular.  
 2 PROFESSOR MINEAR: Well, what if it is though? What if they  
 3 say, "We have a number of different plants that are  
 4 operating here. And yes, it might seem idiosyncratic,  
 5 the way that we're operating in this HEP, but that's how  
 6 we're actually going to operate it in tandem with the  
 7 other plans that we have"?  
 8 This is going back to the question I posed to  
 9 Professor Webb, because I'm not sure that the Court has  
 10 fully addressed that issue yet, of whether India can  
 11 simply choose any design, as long as it uses the MMD and  
 12 stays within the paragraph 15 constraints. And I want  
 13 to make sure that we address this in Treaty terms, so  
 14 that we are answering the argument that India I think  
 15 would raise if they were here.  
 16 DR MILES: In the unlikely event that the anticipated load  
 17 happened to match exactly the paragraph 15 limits, and  
 18 India was able to prove that on a realistic,  
 19 well-founded and defensible basis, backed by evidence --  
 20 they can show us how it's going to fit into the grid,  
 21 they can show that this is absolutely how it's going to  
 22 work in the real world -- then that would presumably be  
 23 acceptable.  
 24 But at least my understanding of the way that power  
 25 plants indicate is that that's not really exactly what

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15:01 1 they're doing here. What they're saying here is, "We're  
 2 not going to bother making any reference to load curve,  
 3 we're not going to bother making any reference to  
 4 anticipated load". What's being said here is that, "The  
 5 mere fact that paragraph 15 exists is enough to meet  
 6 your concerns, Pakistan, and we don't have to do  
 7 anything further". And that's what Pakistan objects to.  
 8 PROFESSOR MINEAR: Just to take one more refinement of this  
 9 argument, because I do think it's important.  
 10 Suppose that India proposes a release schedule to  
 11 maximise pondage and it's idiosyncratic, in your view,  
 12 and you raise an objection saying, "This does not appear  
 13 to be a sensible or realistic, defensible release  
 14 pattern here, and it appears to be to maximise pondage".  
 15 Is it your position that India then has to justify that  
 16 position? And if they can justify this idiosyncratic  
 17 release based on realistic, well-founded and defensible  
 18 projections of how they will use that plant, that that  
 19 would be permissible?  
 20 DR MILES: Provided that they can justify it, I think  
 21 Pakistan would accept that that is the anticipated load  
 22 on the plant, that is realistic, well-founded and  
 23 defensible, and Pakistan would have to live with it, in  
 24 those circumstances.  
 25 But again, I come back to my previous point: it's

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15:03 1 their case to prove, and mere assertion won't do it.  
 2 PROFESSOR MINEAR: Thank you.  
 3 DR MILES: Yes, Professor.  
 4 PROFESSOR BUYTAERT: Thank you, Dr Miles. A few questions.  
 5 And I fully take your point on technicality: you are  
 6 very welcome to pass them on to Mr Rae, but at least  
 7 I would like to give you the opportunity of responding  
 8 if you wish.  
 9 DR MILES: That's very kind.  
 10 PROFESSOR BUYTAERT: First of all, you made the argument  
 11 that hydrology is an important component to take into  
 12 account when determining the installed capacity.  
 13 I think you gave the example of Kishenganga versus  
 14 Swalkot.  
 15 Are there any plants being built or under  
 16 consideration where you think that installed capacity is  
 17 too large and not justified by the hydrology, or is that  
 18 for now just a hypothetical scenario?  
 19 DR MILES: Certainly I said it as a hypothetical scenario;  
 20 I didn't have a particular plant in mind. But that's  
 21 not to exclude the possibility that there are some.  
 22 PROFESSOR BUYTAERT: Okay. Thank you.  
 23 You also made the case of the stability of the load  
 24 curve over different years. You referred to the 1950s  
 25 textbook, and I think in the Memorial you give

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15:05 1 expressly, but that's the methodology that he's setting  
 2 out. He's basically saying: this plant is never going  
 3 to be shut off completely; it is going to be doing  
 4 whatever the power system is doing at any particular  
 5 point in time. That's, functionally speaking, unit  
 6 loading.  
 7 We've only presented unit loading here as one way in  
 8 which India may choose to determine anticipated load.  
 9 But at the same time, as I just said, it's something of  
 10 an antiquated method when you're dealing with a large,  
 11 modern, integrated power system where you've got  
 12 literally hundreds of plants feeding in. In those  
 13 circumstances, you'd be far better off and it's entirely  
 14 justifiable that India would adopt the block loading  
 15 strategy.  
 16 So while at the dawn of the Treaty, if you want, you  
 17 had a small plant in Kashmir with a small, localised  
 18 power system -- and that's not to exclude the  
 19 possibility that such plants and such power systems may  
 20 currently exist in the more remote parts of Kashmir --  
 21 what would be a realistic, well-founded and defensible  
 22 anticipated load for that particular plant, in the  
 23 context of that particular power system, would be unit  
 24 loading as opposed to block loading, because obviously  
 25 if it's the only plant and it's block loading, then the

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15:04 1 an example of a few years.  
 2 DR MILES: Mm-hm.  
 3 PROFESSOR BUYTAERT: Obviously plants are built to be  
 4 operational for decades. Does that argument also hold  
 5 over the lifespan of a plant? And if not, how should  
 6 India take into account in their calculations any  
 7 changes in the demand or operation of the plant over the  
 8 lifespan? Let's say 50 years, that order of magnitude.  
 9 DR MILES: I think that's definitely one for Mr Rae, who  
 10 will be addressing you extensively on that kind of power  
 11 planning and generational expansion planning.  
 12 PROFESSOR BUYTAERT: Okay, thank you.  
 13 The last question, something you haven't mentioned  
 14 explicitly, but it is in the Memorial. (Pause)  
 15 In section 3.46, the concept of "unit loading" is  
 16 introduced, and reference is made to the textbook of  
 17 Doland (Exhibit P-0654, page 51).  
 18 DR MILES: Yes.  
 19 PROFESSOR BUYTAERT: If I'm correct, actually Doland doesn't  
 20 explicitly use the term "unit loading"; it uses another  
 21 term, "unit load curve". And so I'm a bit confused, and  
 22 wondered whether you can explain more the relevance of  
 23 this concept of "unit loading" within the broader  
 24 argument you're trying to making.  
 25 DR MILES: You're right that Doland doesn't use that term

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15:06 1 community is without power for a certain amount of time  
 2 per day.  
 3 PROFESSOR BUYTAERT: To me that just seems to be the use of  
 4 the load curve to adjust the power supply. So "unit  
 5 loading", is that a term that you've come across in the  
 6 literature? Or is that a term, as you define it here,  
 7 that you've defined yourself? Or is it an established  
 8 term?  
 9 DR MILES: Not myself, but that is a term from our  
 10 engineering colleagues. So if you've got further  
 11 questions on unit loading, then it's entirely possible  
 12 that Mr Rae will be able to address them.  
 13 PROFESSOR BUYTAERT: Great. I'm happy to do so.  
 14 That's all. Thank you very much.  
 15 DR MILES: Thank you, Professor.  
 16 THE CHAIRMAN: Dr Miles, I just have a few questions for  
 17 you. I think at least this first one is legal in  
 18 nature, but you can certainly deflect it if you wish.  
 19 So Pakistan I believe acknowledges that contemporary  
 20 data regarding India's power grid is relevant for the  
 21 discussion we're having, and I believe we'll hear more  
 22 about that from Mr Rae. At the same time, as  
 23 I understand Pakistan's position, India cannot seek to  
 24 maximise pondage for the purposes of contemporary or  
 25 even future flexibility, if you will.

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15:07 1 And so I'm just wondering a little bit, as lawyers,  
 2 how we should be thinking in these terms about  
 3 interpreting the Treaty. And the concept of "evolutive  
 4 interpretation" comes to mind. If we're detaching  
 5 ourselves from what was in existence in 1960, whether  
 6 it's in terms of unit loading or block loading or it's  
 7 in terms of what's going on with India's grid on the  
 8 regional or national level, then why is it that India  
 9 designing a HEP to try to take account of flexibility  
 10 that it may need in five years or ten years, recognising  
 11 that the HEP likely is going to exist for decades, why  
 12 is that problematic?  
 13 DR MILES: I don't think I would necessarily say it's  
 14 problematic, so I'm going to sort of push back on your  
 15 description of Pakistan's case. The transcript says:  
 16 "At the same time, as I understand Pakistan's  
 17 position, India cannot seek to maximise pondage for the  
 18 purposes of contemporary or even future flexibility ..."  
 19 I mean, I don't think that's necessarily the correct  
 20 characterisation of Pakistan's case.  
 21 THE CHAIRMAN: I got it out of your Memorial at  
 22 paragraph 3.24.  
 23 DR MILES: Well, then I'd better see what it says at  
 24 paragraph 3.24. So what we say there is:  
 25 "Put another way, India is not permitted Pondage for

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15:10 1 DR MILES: Well, that would be part of an ordinary power  
 2 planning or generation planning analysis, which Mr Rae  
 3 will be qualified to address you on, as to what  
 4 a rigorous, proper power planning analysis would look  
 5 like.  
 6 THE CHAIRMAN: Okay. Let me ask you a different question,  
 7 which again might fall more for Mr Rae, but I'll try it  
 8 out and see where we go.  
 9 DR MILES: Let's see what happens.  
 10 THE CHAIRMAN: As I understand it, the load data that  
 11 Pakistan is relying on relating to the Northern Region  
 12 Grid is for a span of about 18 months, and Pakistan has  
 13 submitted that that's sufficient for then determining  
 14 what would be the basic load curve or power demand that  
 15 one would face with these run-of-river plants. To the  
 16 extent that that information is relevant, I'm wondering  
 17 why one would stay limited to an 18 month period. Why  
 18 isn't several years, even a decade, relevant?  
 19 At one point, you put up on the screen a load curve  
 20 from 1960 or thereabouts, where the weekends looked  
 21 different than the weekdays. Now I believe you're  
 22 representing to us that it's a different story, and that  
 23 it has smoothed out over the course of the week, which  
 24 is suggestive that these things change over time.  
 25 And therefore, why 18 months, rather than a longer

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15:09 1 the sake of Pondage, or for the sake of assumed  
 2 operational flexibility not evident in the actual  
 3 anticipated load of the Plant."  
 4 And your description, Mr Chair, maybe didn't quite  
 5 appreciate the significance of the later part of that  
 6 sentence. All we're saying is that the anticipated load  
 7 on the plant, if it includes future flexibility, it can,  
 8 but that future flexibility has to be actually  
 9 positively proved. It has to be well-founded, realistic  
 10 and defensible, to coin a phrase.  
 11 Again, this all comes back to the question of: what  
 12 India wants to do with its plant has to be proved,  
 13 right? They can't just say, "Well, this plant may need  
 14 to do something that we've not even contemplated in  
 15 future years, we don't know what it might be, and  
 16 therefore we're maximising pondage for that purpose",  
 17 which seems to be, by and large and round about, what  
 18 they tend to do these days; at least they do in some of  
 19 the correspondence that we've looked at.  
 20 THE CHAIRMAN: Well, I suppose that then just turns to:  
 21 how does one prove that in 10 or 15 years it's  
 22 anticipated that renewable energy will be of a certain  
 23 magnitude, and that will affect the way that we operate  
 24 the grid? What is it that Pakistan would be looking for  
 25 in that context?

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15:12 1 period, in order for the Court to fully appreciate the  
 2 power demand that India faces.  
 3 DR MILES: I think that is probably a question for Mr Rae,  
 4 who was responsible for putting that analysis together.  
 5 I think the answer may be that 18 months is the  
 6 information that we were able to pull off the GRID-INDIA  
 7 website, because that's what was available. Maybe more  
 8 data would be better, but 18 months is sufficient for  
 9 present purposes.  
 10 But I'll let Mr Rae elaborate that answer if I've  
 11 gotten it wrong.  
 12 THE CHAIRMAN: Okay.  
 13 You also, in your presentation, revisited an issue  
 14 that Sir Daniel raised, which was the connection between  
 15 paragraph 15 and paragraph 8. And I think Sir Daniel  
 16 was, in essence, asking us to clarify the Award that  
 17 we've rendered; and I think, if I heard you correctly,  
 18 you wanted us to tell you that your description is  
 19 correct.  
 20 In any event, over the lunch break I went back to  
 21 look the portions of the Court's Award and Clarification  
 22 on this particular issue, and I contemplated perhaps  
 23 reading it out to you, but I think that's probably  
 24 unnecessary.  
 25 In my view at least, in the Award on Issues of

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15:13 1 General Interpretation, paragraphs 680 and 681 are  
 2 pretty clear on this issue.  
 3 DR MILES: Yes.  
 4 THE CHAIRMAN: And moreover, the Decision on Pakistan's  
 5 Request for Clarification at paragraphs 44 and 45 are  
 6 also quite clear.  
 7 So I am reluctant to attempt on the fly to provide  
 8 a yet further aspect of these awards for you, but  
 9 perhaps I will go so far as to say: I personally haven't  
 10 heard anything that seems inconsistent with what  
 11 I understand those Award and Decision to mean, and  
 12 perhaps that's sufficiently helpful to you in preparing  
 13 your presentations to us.  
 14 As a last point, on the environmental flow issue,  
 15 I had a question, maybe two questions.  
 16 So one is: the issue of environmental flow that was  
 17 before the Kishenganga Court was somewhat distinct in  
 18 that, as you know, the KHEP does not discharge back into  
 19 the Kishenganga-Neelum River but rather into  
 20 a tributary, the Jhelum. So, on some level, one might  
 21 ponder whether that's a somewhat different scenario than  
 22 perhaps what needs to be applied more generally in  
 23 the context of this Second Phase.  
 24 Perhaps relatedly would be just the issue of whether  
 25 concerns about environmental flows downstream are

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15:15 1 necessarily addressed in the context of the HEP itself,  
 2 or whether it can be addressed through re-regulating  
 3 operations downstream, in which case does that affect  
 4 the way in which we should be thinking about the  
 5 Second Phase decision?  
 6 DR MILES: I think that's definitely a question that will  
 7 benefit from further reflection. So I will park it for  
 8 now, Mr Chair, and I'll come back to you at  
 9 an appropriate point.  
 10 THE CHAIRMAN: Very good. Thank you.  
 11 In that case, Dr Miles, I think you are off the  
 12 hook.  
 13 DR MILES: Why do you say it like that?!
 14 THE CHAIRMAN: Let me express deep thanks for your  
 15 presentation; it was very helpful to us.  
 16 I'm noting the time is now 3.15, Sir Daniel, and  
 17 that we would normally break at 3.30. Unless you think  
 18 otherwise, I propose we break now for a half-hour and  
 19 come back at 3.45, so that Mr Rae can have a straight  
 20 run with us.  
 21 SIR DANIEL: Thank you, Mr Chairman. I think that would be  
 22 fine. We also started ten minutes early, so perhaps  
 23 everyone is entitled to a break now.  
 24 THE CHAIRMAN: Very good. Thank you.  
 25 (3.17 pm)

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15:17 1 (A short break)  
 2 (3.45 pm)  
 3 THE CHAIRMAN: Welcome back, everyone. I understand  
 4 Sir Daniel would like to address the Court.  
 5 SIR DANIEL: Yes, thank you, Mr Chairman, members of the  
 6 Court. You may be forgiven for thinking that Mr Rae has  
 7 shrunk!  
 8 But I'm only going to be here for one minute, and,  
 9 Professor Minear, it's simply to address the question  
 10 that you put to Dr Miles in respect of paragraph 27.  
 11 And I should say that the reason why I'm here just to  
 12 address the question, and to do so immediately now, is  
 13 because we don't want to let this particular issue  
 14 fester and we think that there is a small point that  
 15 needs to be made, so that you go away and have this in  
 16 mind. And I'm doing it rather than Dr Miles because  
 17 I think I'm going to be much more adept at closing down  
 18 any follow-up questions and deferring it to Dr Miles  
 19 tomorrow.  
 20 But there is a very important point which I think  
 21 you've lighted on here, and perhaps we will need to  
 22 reflect for tomorrow about how we elaborate our response  
 23 a little more fully. But if we have a look at this  
 24 highlighted part (PHM-0003, slide 27), which is  
 25 archetypically India's position as we understand it

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15:46 1 to be:  
 2 "... the operation rules in Paragraph 15, allow  
 3 India to hold or release water within a band of 50% to  
 4 130% within a period of seven days. Therefore, there  
 5 can be no objection to [a] Plant generating power in any  
 6 pattern, including peaking, so long as it releases water  
 7 in accordance with Paragraph 15."  
 8 Now, just on the face of this statement, it seems to  
 9 us that there are two quite fundamental problems.  
 10 They may be explicable in terms of a larger Indian  
 11 explanation of its position, but in terms of this  
 12 summation of its position, there seem to be two quite  
 13 significant problems.  
 14 The first one is that India's position as there  
 15 articulated is writing out of the calculation  
 16 paragraphs 8(c), 2(i) and 2(c). It's effectively  
 17 saying: all we need to do is to deliver downstream what  
 18 we get upstream within the period that paragraph 15  
 19 allows. So it's effectively saying: the calculations  
 20 required to achieve maximum pondage by reference to  
 21 the intricate rules of MMD calculation, feeding in to  
 22 paragraph 8(c), drawing on the definition in 2(c), are  
 23 completely irrelevant, because all we need to do is to  
 24 deliver downstream what we get upstream. All of the  
 25 emphasis is placed on paragraph 15.

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15:47 1 The second point, and this may be just a question of  
 2 loose speaking or loose drafting, but the language here  
 3 of India's position effectively takes a 24-hour  
 4 intra-week limitation of 50% to 130% and it elaborates  
 5 it into a weekly limitation: "release water within  
 6 a band of 50% to 130% within a period of seven days".  
 7 That's not what the Treaty says. It says: within any  
 8 period of 24 hours within the seven-day period.  
 9 So there is something that is fundamentally loose  
 10 about the methodology that India is bringing to the  
 11 calculation. What it wants to do is it wants to turn  
 12 paragraph 15 into an ab initio design criterion: as long  
 13 as we release downstream what we get upstream, we can do  
 14 what we want.  
 15 What we say -- and this is why I was at pains this  
 16 morning to take you back to your Clarification  
 17 [Decision] about the difference between the ab initio  
 18 requirements in respect of design and the  
 19 differentiation between the ab initio requirements in  
 20 respect of design and the operational constraints that  
 21 apply afterwards.  
 22 Obviously what the Court has done, which we accept  
 23 and we agree with, and it has roots in the Kishenganga  
 24 analysis, is to say that you can't introduce  
 25 an artificial firebreak between the design criteria in

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15:51 1 My concern is this: India is not here to present  
 2 their arguments. And I think an argument they would  
 3 present, based on what they've said historically,  
 4 primarily in these exchanges at the Commission or  
 5 elsewhere, is that: yes, we agree that we are bound by  
 6 the firm power requirement, we have to use the MMD, and  
 7 we also agree that we're bound by paragraph 15, but  
 8 within those constraints, we have wide latitude to  
 9 choose how we're going to operate our plants. And  
 10 I think that position is in tension with the position  
 11 that Pakistan takes that we have to look to the  
 12 anticipated load and tie it to those matters.  
 13 My concern is simply this: I want to make sure that  
 14 the Court does take into account and address India's  
 15 arguments, and responds appropriately. And to the  
 16 extent that Pakistan can point out succinctly, just in  
 17 terms of bullet points, where, at least for me, I should  
 18 look to see that India is mistaken in that argument,  
 19 that would be very helpful.  
 20 SIR DANIEL: Thank you, Professor Minear, and let me be  
 21 quite clear and transparent. Not only do we understand,  
 22 without attributing anything to your appreciation of  
 23 the answer to that question, but we understand exactly,  
 24 because we want this to happen: that because of the  
 25 absence of our friends here, we need to be tested not

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15:49 1 paragraph 8 and the operational criterion in  
 2 paragraph 15.  
 3 But that's not to say -- and we don't read you to be  
 4 saying -- that's not to say that paragraph 15 is  
 5 a design criterion. It's simply to say that  
 6 paragraph 15 is relevant to the design issues, because  
 7 it comes in -- we've been very cautious about using  
 8 the word "guardrail", but effectively it comes in as  
 9 a guardrail once the installed capacity and anticipated  
 10 load issues have been addressed and identified, and then  
 11 you stress-test it by reference to whether it will work  
 12 in terms of the operational elements.  
 13 So that's the quick response, just to ensure that  
 14 the sort of festering around this doesn't take hold.  
 15 We will come back to it in more detail. I anticipate --  
 16 "anticipate"; I know, because I have his submissions  
 17 here -- that Mr Rae will also be addressing you on the  
 18 upfront longer-term design dimension, but I'm going to  
 19 be leave him to do that.  
 20 So I'm happy if you want to ask any questions now,  
 21 but I'm going to pocket them and give them to Dr Miles  
 22 to answer tomorrow.  
 23 PROFESSOR MINEAR: Thank you, Sir Daniel. I just want to be  
 24 clear on what my concerns here are, because I don't  
 25 disagree with the points that you've just made.

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15:52 1 only by reference to our position as we put forward but  
 2 by reference to what India might be saying. And it's  
 3 quite clear, as you say, that this is what India's case  
 4 would be.  
 5 The reason that I've come back to the microphone is  
 6 simply: we were focusing on this slide. This slide, if  
 7 you like, is taking with a very broad brush and saying:  
 8 this is our case. But there is a fundamental problem  
 9 with the heart of India's case, we believe. We will  
 10 elaborate on this because we think that not only that  
 11 question but, Professor Murphy, the successive questions  
 12 that you put, and, Professor Buytaert, the question that  
 13 you put about: India could gyp the system if it wanted  
 14 to, but it's not, we think these are absolutely critical  
 15 questions.  
 16 There is an engineering response, which you will  
 17 hear now shortly -- and if needs be, we will elaborate  
 18 in due course -- about the rigour of the engineering  
 19 design methodology. There is a legal question, which  
 20 comes back to what I was addressing this morning, which  
 21 is: if you, India, under the Treaty, want to persuade us  
 22 that the projection is well-founded, defensible and  
 23 realistic, give us the detail -- paragraph 9 and  
 24 Appendix II require you to give us the detail -- and  
 25 we will then respond.

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15:54 1 And if you come to us and say, "The United Nations  
2 Panel on Climate Change has been sitting and meeting  
3 here and we've got a 50-year projection on what climate  
4 change is going to do to the flow of the river, and here  
5 is all the granular information about how we get to our  
6 projections of installed capacity and anticipated load",  
7 we will have to sit down -- we, Pakistan, will have to  
8 sit down with India and say, "You've given us a serious  
9 submission, let's have a look at that".  
10 We don't get that from India, which is why what I,  
11 if you like, majored on in my opening remarks is to say:  
12 it's all about the information, because the Treaty  
13 establishes a process. And it's why -- in response,  
14 Professor Minear, you picked up the point -- why I said  
15 that we are contemplating coming back to you with  
16 a small addition to our final submissions, when we read  
17 them out to you formally tomorrow, to say: it's all  
18 about the information, and please -- to the Court -- set  
19 out in as much granularity as you can what you think is  
20 necessary for India to provide to us to allow Pakistan  
21 to say: yes, this is realistic, well-founded and  
22 defensible. At the moment, as you will have got from  
23 Dr Miles, we get very, very little, and certainly  
24 we think it's insufficient.  
25 So, as I say, I just wanted to cap that off, and

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15:55 1 perhaps I can be a little more exuberant in my capping  
2 off than Dr Miles; or maybe that's a little bit  
3 difficult, I don't know. But we will come back to these  
4 issues tomorrow.  
5 PROFESSOR MINEAR: Thank you.  
6 THE CHAIRMAN: Thank you, Sir Daniel.  
7 I invite Mr Rae to the podium for his presentation.  
8 MR RAE: (Slide 1) Mr Chairman, members of the Court, it's  
9 a pleasure to be with you, to be able to address you  
10 again today.  
11 I'll be presenting on the calculation of maximum  
12 pondage under the interpretation of paragraph 8(c) of  
13 Annexure D of the Treaty and as set out in the Court's  
14 Award on General Issues of Interpretation of the Indus  
15 Waters Treaty, and I'll refer to that as "the General  
16 Issues Award" as we go on. In doing this, I'm  
17 accounting for the role of anticipated load and  
18 installed capacity of a power station in the calculation  
19 of pondage.  
20 I'm quite aware that there's a number of pending  
21 questions from the panel, and I intend to go through my  
22 prepared remarks and I expect that you will get  
23 an answer to several of them as I go through. But to  
24 the extent that there's any technical questions, we can  
25 deal with them; any questions of Treaty interpretation,

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15:57 1 I will quickly deflect to Sir Daniel.  
2 (Slide 2) So my purpose today is to expand on the  
3 technical and engineering principles relevant to the  
4 computation of pondage. The legal principles have been  
5 outlined in the preceding presentations by Dr Miles and  
6 Professor Webb.  
7 So my presentation will build on the guidance  
8 provided in the General Issues Award, which has been  
9 discussed in some detail earlier today. I'll refer to  
10 the Award where necessary to set out the basis for the  
11 analysis when setting a methodology for computation  
12 under the Treaty and the Award.  
13 (Slide 3) In the Award, the Court sets out  
14 a conclusion with respect to pondage in paragraphs 745  
15 to 748. Other sections set out the analysis by the  
16 Court, as you're well aware. Information relevant to  
17 the calculation of maximum pondage can be extracted from  
18 the conclusions in the Award, which will supplement that  
19 which is explicitly stated in the Treaty.  
20 Paragraph 745 references paragraph 8(c) of  
21 Annexure D as being the basis for the calculation of  
22 pondage. Firm power is calculated as set out in  
23 paragraph 2(i), being the power determined with  
24 the minimum mean discharge, or "MMD".  
25 The award then proceeds to give several restrictions

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15:58 1 that affect the pondage calculation. First is  
2 paragraph 746, on the slide now, which confirms that the  
3 firm power corresponds to the power available with the  
4 MMD, in accordance with paragraph 2(i) of Annexure D.  
5 The calculation of power itself involves a simple  
6 relationship between flow rate, generating head,  
7 turbine-generator efficiency and other physical  
8 parameters. The only input here determined by the  
9 Treaty is the flow rate. We have previously set out  
10 relevant formula for the calculation of power in  
11 Pakistan's First Phase Memorial, Appendix E2 and  
12 paragraph 4.  
13 In the General Issues Award, however, the Court has  
14 effectively interpreted that the term "firm power" is  
15 equivalent to a fixed amount of energy, which is  
16 determined by continuous generation at the MMD, or in  
17 power terms, the firm power output continuously for  
18 a 168 hour week.  
19 The pondage then determines how that available  
20 energy, or continuous power, can be used within the  
21 power system, without regard to any specific power  
22 output, such as a constraint to operate at the firm  
23 power.  
24 (Slide 4) Next, in paragraph 747, on the slide,  
25 three additional restrictions are set out.

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<p>16:00 1 The pondage must be computed for the volume of water 2 that can be accumulated and released in a seven-day 3 period during which the stream flow is at the MMD. 4 Pondage shall be based on a "realistic, 5 well-founded, and defensible projection of installed 6 capacity and anticipated load", and the calculation 7 shall reflect "the fluctuations in the discharge of the 8 turbines arising from variations in the daily and weekly 9 loads of the Plant". This restriction has several 10 implications in the calculation of the pondage that 11 I will discuss in some detail in my remarks here today. 12 The resulting pondage for firm power must abide by 13 the daily and weekly release requirements in 14 paragraph 15 of Annexure D. 15 Paragraph 748 restates that the computation of the 16 maximum pondage is as defined in paragraph 8(c) of 17 Annexure D. 18 So the Award elaborates on the provisions of the 19 Treaty by referencing installed capacity, anticipated 20 load, and the daily and weekly loads of the plant. And 21 an important restriction in paragraph 747 is the 22 reference to "a realistic, well-founded, and defensible 23 projection". 24 (Slide 5) I'll now discuss these concepts in more 25 detail, and set out how they can be used in combination</p> <p style="text-align: center;">Page 185</p>	<p>16:02 1 configuration at the time of the Treaty, but has evolved 2 with development through the country. 3 We showed the graphics on the slide during our 4 presentations at the hearing for the First Phase on the 5 Merits in July 2024. And on the left, you see the grid 6 regions in India, with the Northern Region including all 7 of the Indus River Basin. The two graphics on the right 8 show the distribution of power and energy among the 9 various energy-generating resources in India. 10 The available resources comprise thermal plants 11 using coal, lignite, gas, diesel and nuclear fuel, 12 hydropower and other renewable sources, including wind 13 and solar. Energy storage is available in reservoirs, 14 with pumped storage hydropower plants and, increasingly, 15 in battery energy storage systems. 16 The distribution that you see here will, of course, 17 change over time. But for the computation of pondage, 18 the load of the plant is determined in the context of 19 this interconnected system, and it's a function of the 20 daily, weekly and seasonal variation in the power demand 21 within that system. 22 (Slide 7) The hourly power generation data for the 23 India power system for 2017 to 2025 is available on the 24 India Climate &amp; Energy Dashboard website, in the form of 25 load duration curves and some sequential hourly demand</p> <p style="text-align: center;">Page 187</p>
<p>16:01 1 with the existing provisions of the Treaty. The first 2 part is to review the meaning of the anticipated load, 3 and for that we must refer to the relevant part of the 4 power system. 5 (Slide 6) The Treaty refers to the load of the plant 6 in Annexure D, paragraph 2(c). And the load of the 7 plant is the contribution of the plant to the overall 8 power system and its load, which can be characterised by 9 the hourly variation of demand at a particular time of 10 the year. 11 The load of the plant must be considered in 12 the context of the total load of the power system, 13 considering the capabilities of other generating plants 14 available within that system, and how those various 15 plants can combine to supply the load. 16 Dealing first with the load of the power system, in 17 a presentation last year, we noted that India has 18 an interconnected grid system with five main regions. 19 For plants in the Indian-controlled part of the 20 Indus River Basin, the relevant power system is the 21 Northern Region Grid. 22 The grid system in India has developed over a period 23 of several decades, with the interconnection of various 24 local grids to form the present integrated system. The 25 system available now did not exist in the same</p> <p style="text-align: center;">Page 186</p>	<p>16:04 1 data. 2 Hourly demand data were extracted from the Northern 3 Region Grid, as illustrated in this figure, for 4 a typical period comprising 2024 and the first half of 5 2025. These data show the hourly demand in the power 6 system, which is the amount supplied by the available 7 generating stations. 8 The width of the blue band on the plot shows the 9 daily variation in the load. And the daily variation is 10 the sum of all of the individual decisions made by 11 thousands of people in their daily use of electricity. 12 (Slide 8) I selected two weeks from this, somewhat 13 randomly, to illustrate what you were seeing in the 14 previous plot. The graph here shows two weeks of the 15 generating data, obtained by zooming in on the plot on 16 the previous slide. 17 The first week was a 168-hour period, starting on 18 16 June 2024, which is within the annual monsoon period 19 when India is typically hot and humid. The second 20 period is the normal winter season -- in this case, for 21 a week starting 5 January 2025 -- when temperatures are 22 cooler, and the Indus River Basin flows are quite low. 23 Note that both weeks commence at midnight, and they 24 represent the typical power system loads, including the 25 weekend and weekdays.</p> <p style="text-align: center;">Page 188</p>

16:05 1 The range or amplitude of the load variation  
 2 reflects the amount of energy storage or pondage  
 3 required for dispatch. And the need for pondage will be  
 4 highest when the amplitude of the daily load variation  
 5 is the largest. The difference in the demand between  
 6 the lowest day and the highest in the week will also  
 7 affect the pondage.  
 8 What is clear from the comparison is that the  
 9 largest range occurs during the winter dry season  
 10 periods. The monsoon season has a much reduced daily  
 11 load range, although a higher absolute load, as  
 12 illustrated in the upper line shown here.  
 13 I'd like to emphasise: this is the data we've  
 14 extracted for India. The figure which Dr Miles showed  
 15 half an hour ago was taken from a textbook not specific  
 16 to India, and from the 1940s or 1950s, so it's not  
 17 specific to this location. The data we are looking at  
 18 is specifically for India.  
 19 (Slide 9) So returning to the annual load variation,  
 20 we can confirm that the period likely to have the  
 21 highest need for pondage are the winter periods, when  
 22 the daily load amplitude is the greatest. And you see  
 23 amplitude illustrated on the slide here.  
 24 The greatest amplitude is in the period from  
 25 mid-December to mid-February annually. And the

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16:07 1 variation of the load shown on this data is related  
 2 largely to seasonal weather variations, while also  
 3 capturing social impacts such as traditional festivals,  
 4 holidays, or other events which tend to be seasonal.  
 5 (Slide 10) For the analysis of the pondage  
 6 requirements, we selected the weeks during the winter  
 7 season from the hourly data. And the periods run from  
 8 6 January 2024 to 24 February 2024, and then from  
 9 7 December 2024 to 8 February 2025. Each of these  
 10 references is to the date at the start of the week. The  
 11 resulting sample has 18 complete weeks, that include the  
 12 effects of a variety of factors that influence the power  
 13 system load. The load is, in effect, an illustration of  
 14 human nature and habits.  
 15 A representative weekly curve was then computed by  
 16 taking the average of the 18 values for each of the  
 17 168 hours in the week. The result is a weekly load  
 18 curve that shows the actual load variation over the  
 19 course of the week, as illustrated here. And note that  
 20 the weekly load curve starts at midnight, so Friday to  
 21 Saturday, so that the first two days are the weekend and  
 22 the following days are weekdays. The average load for  
 23 the week is shown as the straight horizontal line across  
 24 the middle.  
 25 (Slide 11) On the slide now are the load curves for

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16:08 1 each of the 18 weeks that were used to calculate the  
 2 average weekly load curve. You will see that these  
 3 curves are in Appendix D to Pakistan's Memorial. But as  
 4 illustrated, the weekly loads are consistent, with the  
 5 peak-to-trough range and the timing and duration of the  
 6 peak being substantially the same in all cases. There  
 7 are two daily peaks, with the highest being the midday  
 8 peak, and a secondary peak in the evening. The baseload  
 9 is consistent at about 40,000 MW.  
 10 These are the weeks with the largest peak-to-trough  
 11 range as they fall within the dry winter season, which  
 12 would suggest the largest requirement for pondage.  
 13 The review indicates that the average weekly load  
 14 curve computed accurately represents the actual power  
 15 system demands, and is suitable for calculating the  
 16 pondage.  
 17 The energy allocation through the week affects the  
 18 amount of pondage by affecting how much energy or volume  
 19 can be accumulated on weekends in anticipation of the  
 20 weekdays. As shown here, the weekly variations are  
 21 similar, in terms of the timing of the daily peaks and  
 22 the difference between the weekend and weekday peaks.  
 23 (Slide 12) The energy required on each day is found  
 24 by accumulating the power demand through each day,  
 25 effectively converting the megawatts of power demand

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16:10 1 into megawatt hours of energy demand. And this is  
 2 a simple summation of the data.  
 3 THE CHAIRMAN: Mr Rae, I can sense that Professor Minear may  
 4 be ready to jump in, and I was too, but why don't I let  
 5 Professor Minear go first, and then I have a couple of  
 6 questions for you.  
 7 PROFESSOR MINEAR: Thank you, Mr Chair.  
 8 Just a quick question here, and that is that the  
 9 Baglihar Neutral Expert calculated maximum pondage using  
 10 data from the Northern Region from December 2004, and in  
 11 that data he perceived a difference between the weekends  
 12 and the weekdays. Can you explain why this data is  
 13 different?  
 14 MR RAE: I have that specific data on a slide coming up, and  
 15 I'd like to defer that question to that point in time.  
 16 But I think it will be very clear from that, the result.  
 17 PROFESSOR MINEAR: Thank you.  
 18 THE CHAIRMAN: Feel free to defer this question as well,  
 19 which is really just what might be the explanation for  
 20 the same power demand occurring across the week, because  
 21 to a layperson it seems counterintuitive as to why  
 22 suddenly on the weekend you would also have the same  
 23 kinds of demand.  
 24 MR RAE: Well, it's not precisely the same, there are little  
 25 differences: you can see some variation in the energy.

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16:11 1 But keep in mind, this is the aggregate of a large  
 2 number of people doing their daily things. So even what  
 3 you do from day to day is very much the same: you get up  
 4 at a certain time in the morning, you have a meal,  
 5 you're out and about, you're exposed to systems, or  
 6 using air-conditioning or heating, or whichever. And it  
 7 tends over time, when you aggregate large enough, that  
 8 you get consistency of the demand over the whole system.  
 9 THE CHAIRMAN: Well, again --  
 10 MR RAE: Because one individual may vary day to day, but  
 11 when you look at the amalgam of all the individuals,  
 12 there is an integrating effect which brings it back to  
 13 this unity.  
 14 THE CHAIRMAN: Is that the case, in your experience, across  
 15 the world? Because at least in my part of the world,  
 16 I go to my law school Monday through Friday and there's  
 17 air-conditioning; I go there Saturday and Sunday and  
 18 there isn't air-conditioning. One of my children goes  
 19 to a factory five days a week, which hums and does  
 20 things; and then on the weekends, it doesn't.  
 21 So I'm just trying to understand why this might be  
 22 the case in India.  
 23 MR RAE: I'm presenting to you here the data, and this is  
 24 the data that is available for the actual demands of  
 25 the system. And it's not just anymore what is in

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16:14 1 that time was that the Northern Region Grid was  
 2 relevant, this is their load, and that's what they  
 3 presented. And as Professor Minear pointed out, that's  
 4 the data that they presented to the Neutral Expert:  
 5 Northern Regional Grid. And that's the same grid we've  
 6 used here to, in a sense, have consistency.  
 7 I could equally well get you the data for the whole  
 8 of India, but I don't think we'd see very much  
 9 difference. But keeping in mind that if we look at the  
 10 whole of India, you're starting to introduce different  
 11 seasonal and weather conditions in the south of the  
 12 country that might deviate a little bit from the north  
 13 of the country. And power demand is seasonal in terms  
 14 of its influence with weather, so you might see some  
 15 filtering out of that peak that we see in the cooler  
 16 part of the year when the Indus River flows are low,  
 17 because you would be blending in with the large southern  
 18 regions and the eastern and western parts.  
 19 THE CHAIRMAN: But I suppose that was part of what I was  
 20 pondering: whether, depending on the season, depending  
 21 on other circumstances -- perhaps there's flooding in  
 22 a particular region of some kind or another -- that you  
 23 would need to have the grid operate in a way that's not  
 24 region-specific.  
 25 MR RAE: Well, this is a situation around the world: we tend

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16:13 1 industrial or household demands, but it's also  
 2 commercial. There's a combination of commercial,  
 3 industrial, residential, institutional. All of these  
 4 together are making up your total demand.  
 5 But one thing that is known is that as the level of  
 6 development of an economy increases, the variability of  
 7 your demand tends to reduce, so that your baseload comes  
 8 up and your peaks are less defined, so you have more  
 9 uniformity across it.  
 10 To say more, I would have to start to try to collect  
 11 data for other locations that we could try to  
 12 demonstrate this. But at this point in time, what we  
 13 have is the data for India, which is the relevant data  
 14 for what we're trying to solve.  
 15 THE CHAIRMAN: In that regard, the data is specific to the  
 16 Northern Region Grid of India. And one further aspect  
 17 that I don't quite understand is: if the regional grids  
 18 are interconnected, which I understand to be Pakistan's  
 19 position, why is it that you would focus just on the  
 20 Northern Region, as opposed to the demands that might  
 21 require power being sent, I don't know, from the  
 22 Northern Region to other regions?  
 23 MR RAE: Well, that's ... the real answer is: you've got to  
 24 pick something. And if I recall back to what was done  
 25 on the Baglihar case, the position that India took at

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16:16 1 to have interconnected grids that are -- mainly the load  
 2 is dealt with in one part of the grid and it has  
 3 an interconnection to another, but those  
 4 interconnections tend to have capacity limits.  
 5 For example, the Province of Ontario connects to  
 6 the north-eastern United States, but there's a limited  
 7 number of megawatts that can pass through that link, and  
 8 that constrains how much the Ontario system will look  
 9 like the system in Ohio and Michigan. And similarly  
 10 from California to Oregon and California to Arizona:  
 11 there's links, but they're of limited capacity.  
 12 So to pick the Northern Region, which is, from  
 13 a weather perspective, most representative of what we're  
 14 looking at in the Indus River Basin, and at the same  
 15 time being connected with that basin, seemed most  
 16 appropriate for the analysis we're trying to do here.  
 17 THE CHAIRMAN: Thank you.  
 18 If I recall correctly, the State of Texas has its  
 19 own system that does not connect to anyone else.  
 20 MR RAE: And they've had real problems because of that.  
 21 THE CHAIRMAN: They have indeed.  
 22 Please continue.  
 23 MR RAE: So where am I? Okay.  
 24 (Slide 12) Now, keep in mind here, when we're  
 25 looking at the energy, we can convert the energy in

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<p>16:17 1 megawatt hours to flow volume in million cubic metres, 2 and this makes it possible that we can make inferences 3 about the amount of energy storage as it affects the 4 physical storage in pondage. So I can convert megawatt 5 hours of storage to cubic metres of pondage required. 6 And with the average weekly load curve here, the 7 resulting weekly distribution of energy shows that 8 there's a very small difference between the weekend day 9 energy and the weekday energy. The difference is that 10 the weekends are about 98.7% of the average weekly 11 energy and the weekdays are about 100.5% of the average 12 weekly energy, and that's the difference you see on 13 the bar graph at the bottom. 14 And importantly, the variation from weekend to 15 weekday is much, much smaller than the range of flow 16 volume variation permissible under paragraph 15 of 17 Annexure D. 18 (Slide 13) This figure is a way of trying to 19 illustrate the variability of the daily energy 20 distribution by showing a simplified distribution for 21 each day. And I'm referring to the energy here as the 22 parameter that will be used to determine the power 23 dispatched by the plant, and that will be illustrated 24 more as I move ahead. 25 But on this plot, the daily energy is read on the</p> <p style="text-align: center;">Page 197</p>	<p>16:20 1 (Slide 14) Now, given the consistency of the weekly 2 load and the limited variability, the average weekly 3 curve shown here can be used as the load of the power 4 system. If we refer to the wording paragraph 747(b) of 5 the award, the weekly load shown here is a "realistic, 6 well-founded, and defensible projection" of the 7 anticipated load. This load curve is realistic, being 8 actual data; it's well-founded, being data collected for 9 the relevant region of India; and defensible, as being 10 representative of the season of the year. 11 If a unit-load approach were to be adopted, then 12 this curve would show the weekly load that the 13 individual power plant would be required to supply. In 14 a unit-load approach, the maximum demand on the vertical 15 axis is multiplied by a ratio so that the maximum is 16 equal to the capacity of the power system, or the 17 average of the weekly load is matched to the average of 18 the generation available from the plant. 19 The approach is primarily appropriate for a plant 20 serving an isolated power grid, such as an industrial 21 load or an isolated village. When the Treaty was 22 drafted, the grid system in Indian-Administered Kashmir 23 would have been isolated somewhat from the larger grid 24 within India. 25 Most of my following remarks will deal with the</p> <p style="text-align: center;">Page 199</p>
<p>16:19 1 vertical axis and the coloured boxes show the range 2 encompassing 50% of all values, so from an exceedance of 3 25% to 75%. And the whiskers, those little crosses at 4 the top, they represent the maximum and minimum -- as 5 decided by Excel, in all honesty -- excluding any 6 statistical outliers, which are shown as dots. And the 7 simple legend for the figure is shown on the right-hand 8 side. 9 The key thing here is that the figure shows the 10 variability of the energy demand among the days of the 11 week. The median or average values in each day vary, as 12 shown on the previous slide, but there is a variability 13 within each day. 14 Note that while Sunday has a slightly lower 15 distribution, any one of the days has a similar total 16 range of the energy from maximum to minimum. This plot 17 does not show that a single week may have low values for 18 each day; it only shows the range within each day, and 19 the actual variability mixes high and low values within 20 the week. 21 The variability within a week can be attributed to 22 any number of factors that could affect the power 23 demand, including weather. And the distribution within 24 the week must balance, so the low flow value on one day 25 may indicate a higher value on another day.</p> <p style="text-align: center;">Page 198</p>	<p>16:22 1 operation of the plant assuming an interconnected 2 system. And in an interconnected system, this weekly 3 load curve shows only how much energy the plant must be 4 able to dispatch, but the hourly plant load within 5 a given day can deviate from the aggregate hourly 6 demand. The capacity of the plant and the generating 7 duration must be selected to dispatch this energy 8 through the week to meet the requirements of the system. 9 (Slide 15) The other parameter introduced in 10 paragraph 747(b) of the award is the installed capacity 11 and how it can affect the pondage. 12 (Slide 16) As noted by others today, the Treaty does 13 not define the installed capacity for a plant. 14 Annexure D defines the firm power as a function of the 15 MMD, but the installed capacity is left to the 16 discretion of India, although the value is to be 17 supplied as part of the information exchange required by 18 Appendix II to Annexure D. As shown here, India is to 19 supply the designed maximum discharge through the 20 turbines and the maximum aggregate capacity of the power 21 units. 22 The reference is made to firm power and secondary 23 power. And as we noted in the presentations last year, 24 firm power in hydropower practice is required to be 25 dependable, in that it can be provided with a high</p> <p style="text-align: center;">Page 200</p>

<p>16:23 1 reliability.                  2 I will not go into the differences between power and                  3 energy, and will retain the interpretation of the Court                  4 that "power" refers to both power and energy, depending                  5 on the context, as indicated in the General Issues Award                  6 by the content of paragraph 747. From an engineering                  7 perspective, there are important differences that will                  8 be pointed out where a differentiation is necessary.                  9 The maximum aggregate capacity referred to in                  10 Appendix II is equal to the sum of the firm power and                  11 secondary power, both expressed in megawatts. This is                  12 the installed capacity of the plant. Firm power will                  13 usually be much less than the installed capacity of                  14 the plant.                  15 The plant will produce firm energy in megawatt                  16 hours, and secondary power will be the amount of energy                  17 available when the flow rate exceeds the minimum mean                  18 discharge. The amount of secondary energy will depend                  19 on the installed capacity of the plant and                  20 the hydrology.                  21 Based on the Award, the firm power used for the                  22 calculation of the pondage is the energy equivalent of                  23 the firm power being available continuously for a week,                  24 and the corresponding flow volume is of course the                  25 minimum mean discharge multiplied by the hours in</p> <p style="text-align: center;">Page 201</p>	<p>16:26 1 value of secondary energy, with the optimum being found                  2 where the marginal gain of value matches with                  3 the marginal cost of capacity.                  4 I will not deal with this in any more detail here                  5 today because the important issue is really how                  6 the installed capacity affects the computation of                  7 pondage, rather than any issues of economical design and                  8 optimisation.                  9 (Slide 18) So the pondage depends on the actual flow                  10 rate available and the capacity of the plant that is                  11 used for the daily energy balance. Note that the first                  12 part of the discussion here is based on a one-day                  13 period, and I'll come to the calculation over                  14 a seven-day period as I proceed later in the remarks.                  15 The relationship is illustrated here by showing how                  16 the inflow accumulates in pondage when the plant is not                  17 operated, and is then discharged during the operating                  18 period. The figure on the left shows the general case,                  19 with the inflow volume matching the outflow volume but                  20 at a different time of day. The triangular graphic at                  21 the top shows the cumulative flow rate, which initially                  22 stores in pondage before being released as the plant                  23 operates. This is really a mass curve showing the                  24 accumulation of storage and the release of storage, and                  25 the highest point is the pondage required.</p> <p style="text-align: center;">Page 203</p>
<p>16:25 1 the week.                  2 (Slide 17) Installed capacity is simply the rated                  3 capability of the power station to generate power. The                  4 rating is typically for a specific flow rate and                  5 generating head, which are combined with the                  6 turbine-generator efficiencies to give the power                  7 available.                  8 Power varies as a function of the generating head,                  9 and the net generating head available includes the                  10 effect of hydraulic losses, which vary as a function of                  11 the flow rate through the waterway system. The turbine                  12 efficiency depends on the type of turbines, the design                  13 of the turbine runner and decisions made concerning                  14 the most economical rated head and flow for the expected                  15 plant operation.                  16 The installed capacity is defined for a single rated                  17 discharge selected in the design. The installed                  18 capacity is typically determined by an analysis that                  19 balances the value of the energy yield with the cost of                  20 the installed capacity. And the hydrology of the river                  21 determines the energy available, both as firm and                  22 secondary energy, as an input to the economic analysis.                  23 The firm power and energy usually have the highest                  24 economic value to the system. However, the selection of                  25 the installed capacity usually considers the additional</p> <p style="text-align: center;">Page 202</p>	<p>16:27 1 The second figure, on the right, shows the same                  2 situation but with the use of an e-flow. And in this                  3 case, the part of the inflow that can be varied is                  4 stored as pondage for release during the generating                  5 period.                  6 (Slide 19) The figure here establishes some                  7 terminology that I will use in a few moments to show how                  8 the pondage is actually computed. The key elements are                  9 the inflow, the outflow and the duration for the                  10 generation period when the flow is released.                  11 Inflow volume is, of course, the product of the flow                  12 rate and the number of hours in the day. And the inflow                  13 in the figure is the horizontal blue line that is                  14 continuous throughout the day.                  15 The second horizontal line near the base is the                  16 environmental flow, or e-flow, which is also continuous                  17 through the day. This line shows partially in orange                  18 and partially in green.                  19 The orange line shows the discharge, which is at                  20 the e-flow rate for the first part of the day and then                  21 at a peaking discharge during a block loading later in                  22 the day. The peaking discharge and duration of the peak                  23 period are key variables available for adjustment.                  24 The total inflow volume is released downstream as                  25 e-flow or through the power system for energy</p> <p style="text-align: center;">Page 204</p>

16:29 1 generation. And the peak capacity must be combined with  
 2 the duration of the peak so that the outflow volume will  
 3 equal the inflow volume, to maintain the balance.  
 4 We showed a similar figure during our presentations  
 5 in 2024, but this is now adjusted to reflect the  
 6 introduction of capacity as a variable. And I'm  
 7 referring to the capacity for the peaking duration, not  
 8 the installed capacity in this case. The total outflow  
 9 is the product of the capacity during the peak period  
 10 and the duration of that peak period, and the two  
 11 variables must work in concert.  
 12 (Slide 20) The principles illustrated on the  
 13 previous slide can be expressed simply by analytical  
 14 relationships, and if you bear with me for a very small  
 15 amount of mathematics. The purpose of these  
 16 relationships is to show the interrelationship between  
 17 the pondage, capacity, peaking time and inflow.  
 18 The formulas are for a case of block loading, which  
 19 is what was illustrated previously, and in this case  
 20 the plant discharge increases from zero to a capacity  
 21 instantaneously and then reverts to zero at the end of  
 22 the peaking duration. And this is what was illustrated  
 23 in the previous slide.  
 24 I'd like to point out that this loading is  
 25 unrealistic and it would not be practically achievable.

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16:32 1 Pondage is the volume, of course. And the peaking flow,  
 2  $Q_p$ , converts to the capacity, in megawatts, which would  
 3 be the installed capacity in the limit. In practice,  
 4 the capacity used for peaking may well be lower than  
 5 the installed capacity.  
 6 The capacity used for peaking is the load of the  
 7 plant when considering the anticipated load for supply  
 8 in response to the power system demand.  
 9 (Slide 21) We will not dwell on the mathematics  
 10 here, but I want to illustrate what this means in  
 11 a practical sense.  
 12 In this figure, we use the minimum mean discharge as  
 13 the inflow, the  $Q$  value in the equation. The  
 14 relationship then can be used to calculate the pondage  
 15 as a function of the peaking discharge capacity, which  
 16 is what's shown on this figure. This relationship is  
 17 for the Kiru HEP, but could easily be computed for any  
 18 plant. The curve shown in the figure is exactly the  
 19 result of the third formula shown in the preceding  
 20 slide, which is inserted in the bottom here.  
 21 The curve is determined for the values of  $Q$  and  
 22 e-flow rate provided by the Court in the spreadsheet  
 23 that was provided to us. And on the horizontal axis at  
 24 the bottom, we vary the peak period flow rate. The  
 25 graph then shows the pondage when the peak period flow

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16:30 1 However, it's used here to establish the limits of the  
 2 pondage in the calculation, as is commonly done.  
 3 So the first equation is simply stating that the  
 4 inflow volume, which is  $Q$  times 24 hours, can be  
 5 released in a shorter period,  $t_p$ , if it is discharged at  
 6 some peaking capacity. So the formula here is  
 7 equivalent to saying, for example, that 2 times 12  
 8 equals 3 times 8. So we're in primary school.  
 9 The second equation shows that the pondage volume is  
 10 the volume of water that is stored when the plant is not  
 11 discharging, but inflow is accumulating. The principle  
 12 is that if you're not discharging, then the volume  
 13 accumulated must be equal to the inflow multiplied by  
 14 the number of hours with no outflow, and it's simply  
 15 what the expression shows.  
 16 The third equation is a combination of the two, but  
 17 by including the e-flow to the extent it's necessary,  
 18 which must be released continuously so it doesn't affect  
 19 the volume at the peak. E-flow is considered when  
 20 required, but does not change the methodology itself.  
 21 The volumes in both equations are converted to  
 22 million cubic metres by including the 0.0036 factor.  
 23 These are simple volume balance relationships that  
 24 we can use to illustrate the importance of the various  
 25 parameters identified for the calculation of pondage.

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16:33 1 rate is varied up to the rate of discharge for the  
 2 installed capacity.  
 3 Note that the inflow and the e-flow rate are both  
 4 constant in this calculation. The horizontal axis is  
 5 the flow rate during the peaking period. And if there  
 6 was no e-flow, the entire curve would shift up a little  
 7 bit, because you would have a zero value entered in  
 8 place of the  $Q_e$  parameter in the equation.  
 9 For the calculation of pondage, as I mentioned,  
 10 the inflow rate is the MMD, and the e-flow is deducted  
 11 in the equation, as it shows here.  
 12 What is apparent is that the pondage increases as  
 13 the capacity increases during the peaking period.  
 14 However, the rate of increase moderates at the higher  
 15 value of capacity, which is consistent with  
 16 the observation that was made earlier today. I've shown  
 17 the curve up to the installed capacity flow rate at  
 18 the right end of the plant.  
 19 A similar plot can be produced for any plant by  
 20 adjusting the various input parameters.  
 21 (Slide 22) Keep in mind that the volume must remain  
 22 in balance, with the outflow equal to the inflow. When  
 23 the peak-period flow rate increases, the only way this  
 24 is possible is to reduce the duration of the peaking.  
 25 This is what's shown in the figure here. There is

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16:35 1 an orange line now plotted. The pondage volume line is  
 2 the same as the preceding figure -- that's the one in  
 3 blue -- but I have included the peaking duration  
 4 associated with the capacity that is required to  
 5 maintain the inflow and outflow volumes in balance, and  
 6 that's the orange line. Again, the figure shows the  
 7 variation up to the installed capacity at right end of  
 8 the curves.  
 9 If the plant were required to peak at the installed  
 10 capacity, then the pondage would be at the maximum value  
 11 on this figure. However, the plant would only be  
 12 available for less than two hours per day, in the case  
 13 of the Kiru.  
 14 As we've noted, the Treaty does not impose a limit  
 15 on the installed capacity, which, as illustrated here,  
 16 leaves the pondage similarly unconstrained. If the  
 17 installed capacity were larger, the curve would extend  
 18 further out, albeit at a continually relatively flat  
 19 slope.  
 20 But the relationships here can be used to find the  
 21 pondage required for any assumed daily peaking time and  
 22 the associated daily peak-period flow rate. For  
 23 example, as shown by the arrows, if we give eight hours  
 24 of peaking, we have a peak-period flow rate -- taking  
 25 the arrow going down -- of 146 cubic metres per second;

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16:36 1 and reading off the blue curve, we get a pondage  
 2 required of 2.8 million cubic metres.  
 3 (Slide 23) If we were to use a different daily  
 4 duration of six hours, then the peak-period flow rate is  
 5 194 and the pondage is 3.15 million cubic metres.  
 6 And note that the pondage values I'm stating here  
 7 are directly from the calculation and they have not been  
 8 multiplied by 2, as required by paragraph 8(c) of  
 9 Annexure D, in calculating the maximum pondage. And  
 10 that will be a general statement through the  
 11 presentation: I'm dealing with the base numbers first.  
 12 The relationship illustrated here shows what's  
 13 analytically possible. This is only part of the story.  
 14 We must also consider the restrictions set out in  
 15 the Award that the pondage be calculated based on  
 16 a "realistic, well-founded, and defensible projection"  
 17 of the installed capacity and the anticipated load. In  
 18 this context, I'm referring to the load of the plant,  
 19 and we must also extend this calculation to  
 20 the seven-day period.  
 21 I'll come back to the load of the power system in  
 22 a few minutes, when we discuss the seven-day operation.  
 23 But firstly, given that the analytical relationships for  
 24 pondage within a day can be well defined, the test of  
 25 what is "realistic, well-founded, and defensible

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16:38 1 projection" requires that we consider how a run-of-river  
 2 plant would actually be used.  
 3 There are no fixed rules for how plants will be used  
 4 in a power system. However, we can make several  
 5 observations based on industry guidelines and by  
 6 considering the practicalities of how a power system  
 7 might operate.  
 8 (Slide 25) The first observation is that the energy  
 9 available from the plant will vary seasonally. The  
 10 figure here shows the ten-day mean discharges for the  
 11 Kiru HEP that were used to compute the minimum mean  
 12 discharge.  
 13 The first thing to note is that the MMD is the  
 14 orange dashed line at the base of the figure, as  
 15 expected, given that the firm power is required to be  
 16 dependable, therefore available at all times.  
 17 The firm energy or power is the energy available in  
 18 the zone between the MMD and the base of the figure, if  
 19 the volumes were converted to energy. The low value of  
 20 the MMD ensures that the firm power would be available  
 21 in most years and weeks.  
 22 The next observation is that the plant capacity  
 23 allows for generation of secondary energy with the flows  
 24 above the MMD. That capacity is the blue dashed line.  
 25 The secondary energy is likely much larger than the firm

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16:39 1 energy. The availability of the secondary energy and  
 2 its value in the power system is what justifies the  
 3 selection of the installed capacity, which is then  
 4 largely unrelated to the firm power and the energy  
 5 available during the dry season.  
 6 A significant part of the year has the available  
 7 flow rate higher than the rated flow rate for the  
 8 installed capacity. During this season, the maximum  
 9 amount of energy can be obtained with the plant  
 10 operating at its full capacity. The full capacity is  
 11 not required during the winter months, and a rational  
 12 hydropower operator would plan for any scheduled outages  
 13 to take place during this flow period, when the outage  
 14 would not affect the energy generation.  
 15 Importantly, a river with a high sediment load will  
 16 cause some damage to the turbines during the high-flow  
 17 period. Maintenance outages will be required, at least  
 18 for turbine inspections, but possibly also for repairs.  
 19 These maintenance outages are scheduled during the  
 20 low-flow periods, when the hydrology does not provide  
 21 enough flow to operate the generating units, especially  
 22 if a large installed capacity is selected based on the  
 23 wet-season secondary energy.  
 24 (Slide 26) Having identified when maintenance is  
 25 scheduled, it is now important to identify how long

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16:40 1 a typical unit is out of service for maintenance.  
 2 Utilities collect information about the outage of  
 3 every generating unit in the systems. This is used for  
 4 system planning, but also for planning unit preventative  
 5 maintenance and replacements.  
 6 Three broad classifications of outage can be  
 7 considered: forced outages, planned outages or  
 8 maintenance outages.  
 9 Forced outages occur at any time, and are typically  
 10 in the range of 2% of the year for hydropower. A forced  
 11 outage would be like getting a flat tyre on your car:  
 12 some people have them fixed at the moment.  
 13 Planned outages are for units shut down for repairs  
 14 that are immediately necessary but can be deferred to  
 15 a convenient time. This might be changing the wiper  
 16 blade on your car. They can occur at any time of the  
 17 year.  
 18 But maintenance outages are those that occur on  
 19 a specific scheduled time, and are of most interest for  
 20 the discussion today. Hydropower maintenance outages  
 21 vary through the life of the unit, but minor maintenance  
 22 will generally be about two to three weeks per year,  
 23 plus the time required for draining and refilling of  
 24 water passages. Major maintenance will occur every five  
 25 to ten years, and will require an outage of four to

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16:43 1 or three units at a time, that does happen, absolutely.  
 2 But what would happen in that case, if you're  
 3 considering that you've got a much lower flow rate  
 4 during the dry-season period, [is] that the remaining  
 5 units would then be operating at a much higher discharge  
 6 flow during that period so that you capture the same  
 7 amount of energy.  
 8 So it's really a point of: you can take as many  
 9 units out as you want, provided that you don't impair  
 10 the ability to generate the energy.  
 11 But the other thing that mitigates against that  
 12 approach is that, typically, power plants have a limited  
 13 number of staff available for maintenance, and you end  
 14 up in a situation where you don't want to be doing  
 15 maintenance on more than one unit at a time because it's  
 16 a manpower resource allocation problem. But it is  
 17 possible and it has been done. But if you were to do  
 18 that, it would work towards the position I'm leading to:  
 19 that that tends to reduce the amount of pondage that's  
 20 required because you don't have as much available to you  
 21 of capacity.  
 22 THE CHAIRMAN: If you're going to get to it, that's fine.  
 23 But I would have thought it's the other way around: that  
 24 if you're going to not have as many units available, you  
 25 can't push as much water through at the same time, so

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16:42 1 six weeks. Plants that are exposed to high sediment  
 2 load can be expected to have longer outage periods  
 3 because of the need for inspections and interim repairs  
 4 to the turbines.  
 5 A realistic plan for calculating the pondage should  
 6 therefore recognise that the available capacity will be  
 7 reduced by the requirement to have units on maintenance  
 8 outage. And maintenance is usually scheduled  
 9 sequentially for units during the dry season. In  
 10 a plant with four units, this would mean that the  
 11 available capacity will be 75% of the total installed  
 12 capacity for a period of several weeks during each dry  
 13 season.  
 14 THE CHAIRMAN: Mr Rae, could I pause you there, because  
 15 I'm wondering: in a system where you have multiple HEPs  
 16 connected to a grid, are there situations where, for  
 17 a particular HEP, you might take more than one turbine  
 18 offline to do repair work, allowing the other HEPs to  
 19 take up the slack, if you will? Because if so, then I'm  
 20 wondering if an assumption that there would only be one  
 21 turbine taken off in the course of a six-month period  
 22 maybe wouldn't be correct.  
 23 MR RAE: Yes, and the assumption of one is having the least  
 24 effect on the pondage. If the plant were done in such  
 25 a way that an operator wanted to go in and take out two

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16:45 1 you'd want to have some pondage so that, over the course  
 2 of time, you would be able to push the water through.  
 3 MR RAE: No, but keep in mind you've got a fixed volume of  
 4 water on a given day, and that volume is released -- or  
 5 must equal the peak duration multiplied by the capacity.  
 6 And if I reduce the capacity instead of by 75% to 50%,  
 7 then I have to increase the duration. And once I've  
 8 increased the duration, I'm ponding for fewer hours,  
 9 therefore I can only accumulate less pondage to use  
 10 within that time.  
 11 THE CHAIRMAN: Thank you. Please continue.  
 12 MR RAE: (Slide 27) Hydropower turbines themselves are  
 13 subject to several constraints in respect of their  
 14 operating ranges. And the figure here shows a typical  
 15 Francis turbine hill chart, what we refer to as a "hill  
 16 chart", and this is the turbine type selected for the  
 17 Kiru HEP.  
 18 There is a lot of information shown on this diagram,  
 19 but it's going to suffice to note a few principles.  
 20 One is that the installed capacity is also referred  
 21 to as the "rated capacity", and that's the rating point  
 22 that you see here, the slightly reinforced bit in the  
 23 middle. The rated capacity is a fixed design head and  
 24 a full turbine gate conditions. So the turbine gates  
 25 are fully open and it's discharging at its maximum

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16:47 1 capacity.  
 2 The maximum power, or discharge through the turbine,  
 3 varies with the head, and this is the sloping red line  
 4 to the right side. And the maximum the turbine can  
 5 discharge follows that sloping line.  
 6 There's a maximum and minimum head limit, which are  
 7 shown upper and lower on the diagram. These are  
 8 important for storage reservoirs, such as under  
 9 Annexure E to the Treaty.  
 10 And the firm power for an Annexure E plant is the  
 11 point where the capacity limit is at the minimum head,  
 12 so it's the point where that sloping line on the right  
 13 side meets the red line at the bottom. That's the firm  
 14 power for an Annexure E plant, and it's independent of  
 15 the hydrology.  
 16 The turbine efficiency varies as illustrated by the  
 17 curving lines in the middle of the diagram. The best  
 18 efficiency point, which I've identified with an arrow  
 19 there, is located at a discharge less than the rated  
 20 condition. In this example, the best efficiency flow  
 21 rate is about 80% of the flow rate at the rated  
 22 condition.  
 23 There is also a minimum capacity limit below which  
 24 the turbine is subject to damages caused by the flow  
 25 conditions.

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16:50 1 determines the maximum time that the turbine can be  
 2 operated in any day, and this limit is in the order of  
 3 50% of the rated flow for a Francis turbine. And when  
 4 combined with the minimum mean discharge, it sets the  
 5 maximum number of hours that the plants can operate in  
 6 a day.  
 7 THE CHAIRMAN: Mr Rae, before you move on, on that slide,  
 8 do I understand correctly that Pakistan's position is  
 9 that the installed capacity should basically be reduced  
 10 to the point of the best efficiency of the plant?  
 11 MR RAE: No.  
 12 THE CHAIRMAN: Could you clarify that then for me?  
 13 MR RAE: No, no, the installed capacity can be selected  
 14 wherever it will be. But on a day when you have a flow  
 15 rate less than the maximum capacity of the turbine, you  
 16 would choose to operate at a flow rate near the best  
 17 efficiency point for that day and determine the number  
 18 of hours of operation so that you're operating at the  
 19 best efficiency. By doing that, you're maximising your  
 20 energy production.  
 21 If you were to operate at the installed capacity for  
 22 that day, you would operate for fewer hours and you  
 23 would produce less energy because you're giving up the  
 24 efficiency and you're giving up head losses.  
 25 THE CHAIRMAN: The reason I asked was I thought I read in

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16:48 1 A rational plant operator will always want to  
 2 operate the turbines close to their best efficiency  
 3 points. The efficiency of the turbine in this case can  
 4 be about 2 to 3 percentage points higher than at the  
 5 rated condition. In addition, the lower flow rate at  
 6 the best efficiency point means that the head loss of  
 7 the waterway is lower, again resulting in a higher  
 8 energy output for a given flow rate.  
 9 So a realistic, well-founded and defensible  
 10 projection of the plant capacity during the dry season  
 11 would mean that the operator would select a turbine  
 12 discharge close to the best efficiency point each day.  
 13 The discharge at this point would be below the maximum  
 14 capacity of the unit, but the operator would maximise  
 15 the energy potential by achieving a higher turbine  
 16 efficiency and lower head losses, albeit with a longer  
 17 daily generation time.  
 18 Operation at this point also inherently builds in  
 19 what's referred to as a "spinning reserve capability" in  
 20 the power plant. It gives additional flexibility for  
 21 the operation by being at that point because if the load  
 22 changes for some unanticipated reason, the plant can  
 23 adjust its load up or down around that point, whereas if  
 24 it's at the maximum, the flexibility is gone.  
 25 The minimum capacity limit is important in that it

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16:51 1 the Memorial, at paragraphs 3.59 and 5.7, that Pakistan  
 2 was arguing that the installed capacity should be  
 3 reduced to this best efficiency point. But that is not  
 4 the position?  
 5 MR RAE: No, no, the interpretation is that it's operated at  
 6 that. So I would have to read precisely what was said,  
 7 but the meaning is that in this period you would want to  
 8 operate at that best efficiency point. It doesn't  
 9 impose a constraint on the installed capacity.  
 10 And think about it: if you were to design the  
 11 turbine for that lower installed capacity, you would  
 12 shift the whole curve over; the whole curve would shift  
 13 over so that you're back to the same position.  
 14 THE CHAIRMAN: That makes sense to me.  
 15 A related question: in actual practice, is it your  
 16 experience that turbines are typically being operated at  
 17 that efficiency point, or does it depend?  
 18 MR RAE: Yes. Operators want to hit that sweet spot for  
 19 a number of reasons. One is it gives them more energy.  
 20 But two, it's easier on the turbine: it's less wear and  
 21 tear on the machine if it's operating at that ideal  
 22 point. And then from the power system operator  
 23 perspective, they like it because it gives them that  
 24 spinning reserve capability in the power system.  
 25 What I mean by that is if, for example, some plant

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16:53 1 somewhere else goes offline for a forced outage, or  
 2 whatever it may be, the power system will then see  
 3 a reduction of the frequency, which is little flickers  
 4 we see in the lights. And what will happen at this  
 5 plant is then, if it's operating at best efficiency  
 6 point, it's got surplus capacity available, so its  
 7 governor will allow it to open up the gates and increase  
 8 its discharge. So it's giving it that flexibility.  
 9 And of course the converse happens: if another plant  
 10 comes on suddenly at some point to start its generation,  
 11 there is again a reduction required and it would tend to  
 12 shift about that point, but coming back to a set point,  
 13 which is near the best efficiency point.  
 14 So that's the ideal or where you want to be. But  
 15 the key thing is from the plant owner's perspective,  
 16 they're making more money, because they're generating at  
 17 a higher efficiency for the same unit of water. So  
 18 they're getting more out of it. The power system  
 19 operator gets more out of it because that ancillary  
 20 service costs him money from something: he's got to have  
 21 plants in the system to do that. So he's getting that  
 22 capability.  
 23 THE CHAIRMAN: Very good. Thank you.  
 24 SIR DANIEL: Mr Chairman, perhaps, with apologies to Mr Rae,  
 25 before he continues, just as a housekeeping matter.

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16:55 1 reduced from 586 cubic metres per second to 374, which  
 2 is the arrow shown here. And pondage in this case would  
 3 reduce from 3.9 million cubic metres to 3.7, which is  
 4 where you see the black arrow going there. The daily  
 5 peak duration would increase to 3.1 hours, where  
 6 previously it was about 2.  
 7 (Slide 29) So the constraints just described are  
 8 imposed by the technical design of the power plant  
 9 itself, and another set of constraints is imposed by how  
 10 the plant will operate within the power system.  
 11 In India's calculation of the maximum pondage at  
 12 Kiru, one of the assumptions made was to maximise  
 13 pondage by saying that the plant can operate for a short  
 14 daily peak period with the highest possible capacity.  
 15 This assumptions imposes conditions on the power system  
 16 that affects how the other power stations must operate,  
 17 and that imposition must be reasonable for  
 18 the assumption to be realistic.  
 19 And I just noted that these short operating periods  
 20 are not consistent with the expected operation to  
 21 maximise energy production from the plant because  
 22 they require operation at full capacity, rather than  
 23 rationally at best efficiency and allowing for its  
 24 maintenance outage.  
 25 (Slide 30) And recall the weekly load curve, which

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16:54 1 You raised a little bit earlier on our appreciation  
 2 of our timing, and I have Mr Rae's slides open in front  
 3 of me and I see that there are still a number to go.  
 4 Under your PO18, there is a latitude for us to apply to  
 5 you to vary the timing. And I'm just wondering whether  
 6 there is any flexibility on the part of the Court to go  
 7 beyond 5.30 to allow Mr Rae a little more latitude to  
 8 complete his presentation. Otherwise there's going to  
 9 be a hard stop at 5.30 for the Court's questions.  
 10 THE CHAIRMAN: I think we do have some latitude. We will  
 11 try to be judicious in our own questions. But let's  
 12 proceed on the understanding that there may be a need to  
 13 spill over a bit beyond that point.  
 14 SIR DANIEL: Thank you very much.  
 15 MR RAE: I'll try to be a little bit speedier, if possible.  
 16 (Slide 28) If the effect of maintenance outages and  
 17 operation at best efficiency are combined, which is  
 18 reasonable and defensible, then the effective capacity  
 19 imposes a limit on the pondage, which is a follow-on to  
 20 the question you had earlier. And the analytical  
 21 relationship described applies as a means of showing  
 22 the results.  
 23 So in the case of the Kiru HEP, one unit on outage  
 24 reduces capacity to 75%. And if the units are operating  
 25 at, say, 85% of the peak capacity, then the flow is

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16:57 1 I showed here, and this shows how the load of the power  
 2 system varies through the week.  
 3 (Slide 31) If we focus on one of the days, going on  
 4 to the next one, the figure here shows the load from  
 5 hour 72 to 96, being Tuesday in the middle of the week.  
 6 The load reaches a minimum of about 36,000 MW during  
 7 the early morning hours and a maximum of about 63,500 at  
 8 about 11.00 am, and a secondary maximum of about 58,000  
 9 at about 8.00 pm. And recall this is the actual load  
 10 data extracted from Northern Region.  
 11 The duration of the daily peak is about 20 hours,  
 12 from the increase starting about 6.00 am to the end in  
 13 the evening at about 11.00 pm. And the base of the  
 14 figure, at about 36,000 MW, only operates for a short  
 15 period of time.  
 16 Dispatch of power plants to supply the peak must  
 17 consider the duration and magnitude of the peak load on  
 18 the power system. A very short duration of one or  
 19 two hours would be inconsistent with the actual demands  
 20 of the power system, which is what we see here.  
 21 (Slide 32) So the values shown here -- not very  
 22 clearly unfortunately -- are extracted from the US Army  
 23 Corps of Engineers Hydropower Engineer Manual  
 24 (Exhibit P-0302). They are by no means a strict  
 25 definition of the type of plant, but are rather

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16:58 1 indicative of the terminology used when discussing  
 2 plants.  
 3 Baseload plants operate almost continuously to  
 4 supply the power demand. These plants typically produce  
 5 energy with lower cost or are plants that are  
 6 constrained. India makes extensive use of coal plants  
 7 for baseload.  
 8 A peaking plant operates for a few hours of the day.  
 9 In power systems, this service is often from hydropower  
 10 plants with unconstrained storage, gas turbines or  
 11 diesel plants, all of which can start quickly but  
 12 operate only a short time. More recently, we are seeing  
 13 increasing use of batteries for supply to the peak. And  
 14 India is also developing pump storage plants for daily  
 15 peaking and for hybrid operation with solar generation.  
 16 Intermediate load plants operate from a few hours to  
 17 12 or 16 hours in a day. Typically, they will start up  
 18 in the morning and generate through the day until  
 19 the load reduces in the meaning.  
 20 (Slide 33) So looking at the daily load, we can  
 21 allocate the various regions in the graph according to  
 22 the broad definitions just described.  
 23 Baseload is the part at the bottom, where the  
 24 generating plant is available through the full day, and  
 25 comprises most of the energy. A run-of-river plant will

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17:01 1 plant with pondage in that the amount of energy storage  
 2 is determined as part of the system design. The energy  
 3 storage in a run-of-river plant will always be limited  
 4 by the hydrology, and therefore is not as convenient to  
 5 the system.  
 6 (Slide 34) It remains to be seen what is reasonable  
 7 criteria for the daily dispatch. The Treaty makes no  
 8 reference to how the plant will be used, and the only  
 9 reference to "peak" or "peak power plant" in Treaty is  
 10 in paragraph 24 of Annexure E, which refers to a peak  
 11 power plant as part of a storage work.  
 12 So in the absence of specific guidance from the  
 13 Treaty, the anticipated load can refer to the load of  
 14 the power system. And as illustrated in the preceding  
 15 slide, the peak period is expected to be about 4 to  
 16 6 hours, depending on when the plant is dispatched. Any  
 17 plant serving this load would be brought online only  
 18 when necessary and then continue operating through  
 19 the peak. The load would vary through the peak as the  
 20 demand varies.  
 21 A theoretical minimum is obtained by considering  
 22 the stacking position of the plant in the load duration  
 23 curve, and this is something we discussed in the  
 24 presentation in 2024. The curve here was computed using  
 25 the same hourly demand data that were described earlier.

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17:00 1 be in the baseload during the wet season, because the  
 2 available flow rate exceeds the capacity of the plant.  
 3 The peak load is the small requirement at the top of  
 4 the figure, which is about 4 hours in this illustration  
 5 or 6 hours if you include the secondary peak. The  
 6 illustration here is my allocation of the zones, but the  
 7 load is the actual load of the Northern Region Grid.  
 8 The intermediate load is the largest part of the  
 9 variable energy, and in this example provides generation  
 10 of about 16 to 18 hours, with the load varying through  
 11 the day. In my experience, this is the most common use  
 12 of run-of-river power stations in the dry season.  
 13 It does make use of pondage, but in a way that is able  
 14 to best serve the system.  
 15 The purpose of examining the daily load is to assess  
 16 what is reasonable, well-founded and defensible as  
 17 a projection of the HEP's anticipated load. We're  
 18 trying to assess how a plant would be used on a given  
 19 day, both in terms of its capacity but also in terms of  
 20 how many hours of generation would be planned for the  
 21 dispatch of the available plant.  
 22 Pumped storage plants designed for peaking usually  
 23 allow for storage to enable operation for more than 4 to  
 24 6 hours, which represents the peak duration for power  
 25 planning. Pumped storage differs from a run-of-river

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17:03 1 If the plant is placed at the position shown here,  
 2 then the energy is produced with the full capacity. The  
 3 result is a generating time of less than about 2.2 hours  
 4 per day, which is not very much. However, this position  
 5 is determined with the installed capacity based on  
 6 secondary energy and is unrelated to the production of  
 7 the firm power and energy.  
 8 The plant would stack a lower position with longer  
 9 generating time if the available energy were reduced.  
 10 And the stacking position gives the change in load from  
 11 the time when the plant starts operating until it  
 12 reaches the capacity planned for the day. In this case  
 13 I believe it's it about 18 minutes we have as  
 14 the ramp-up and ramp-down of the plant.  
 15 However, as I illustrated earlier, the actual peak  
 16 duration of the demand is about 4 hours. In practice,  
 17 the power system dispatch operator could be expected to  
 18 select plants for operation during the full duration of  
 19 the peak and to allow the load on each plant to vary as  
 20 needed to meet the demand. This practice would extend  
 21 the plant time to a minimum of 4 hours and would also  
 22 increase the flexibility of the power system by  
 23 increasing the reserve capability.  
 24 Operation with a duration less than 4 hours would  
 25 require the system operator to stop and start multiple

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17:04 1 plants through the period of the peak, which would be  
 2 technically disruptive to the power supply and  
 3 administratively difficult.  
 4 (Slide 35) So we'll come back to the issue now of  
 5 the appropriate dispatch of the weekly plant, and I'd  
 6 like to discuss the effect of weekly operation on  
 7 the required pondage.  
 8 This is important: as pointed out by my colleagues  
 9 earlier today, post-Baglihar projects considered by  
 10 India have assumed a significant weekly pondage  
 11 accumulation by adopting paragraph 15 of Annexure D as  
 12 a design criterion. Effectively they're accepting  
 13 a minimum mean discharge in paragraph 15 and then having  
 14 no reference to firm power.  
 15 My purpose here is to explore what pondage is  
 16 actually required when considering the load of the power  
 17 system within which the power plant is operated.  
 18 (Slide 36) So if we return to the weekly load curve,  
 19 which is the relevant system, there is a small  
 20 difference between the energy demand on weekdays and  
 21 weekends, but every day has a similar pattern. And that  
 22 reinforces that we are, to a large degree, creatures of  
 23 habit, on aggregate, and we tend to follow much the same  
 24 activities daily.  
 25 (Slide 37) If we look at the Kiru case, we can scale

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17:07 1 it has the units of megawatt hours.  
 2 The demand line is the hourly load from the previous  
 3 slide, which, if you sum them, also comes to 8,707  
 4 because we've matched the averages.  
 5 The energy storage that's required is the maximum  
 6 difference between the firm power mass curve and the  
 7 demand mass curve. In this case, the maximum comes out  
 8 to about 140 MWh, which occurs on the third day of the  
 9 week after the weekend, when the demand was slightly  
 10 lower. Energy in megawatt hours can be converted to  
 11 reservoir volume by noting that the firm power of  
 12 51.83 MW corresponds to the flow rate of 48.67 cubic  
 13 metres per second. The ratio then gives about  
 14 0.47 million cubic metres.  
 15 This is the pondage that would be required if the  
 16 plant were operated on a unit-load basis, where the  
 17 plant output exactly matches the system demand.  
 18 The theoretical pondage for weekly operation with  
 19 the actual power system load is therefore quite limited.  
 20 And this is a reflection of the minor difference in load  
 21 [in] the Northern Region Grid between the weekend and  
 22 weekdays.  
 23 From a power system perspective, it's reasonable  
 24 that a plant would be used to supply power in accordance  
 25 with the demand. And if there was a requirement to

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17:06 1 that same demand to match the average energy of the Kiru  
 2 HEP by setting the average of that equal to the firm  
 3 power, which is essentially what is stated in the Award.  
 4 A plant could, in theory, be designed to follow this  
 5 pattern precisely, with the load varying by adjusting  
 6 the number of turbines operating and the capacity of  
 7 each turbine. We did refer to this as a unit-load  
 8 approach, which may have been applicable for an isolated  
 9 grid system.  
 10 In our analysis, however, we assume there will be  
 11 a daily peaking imposed on top of this curve, as we've  
 12 discussed in the previous parts. What's of interest  
 13 here is how much pondage is required to enable the firm  
 14 power to be distributed according to the load demand.  
 15 We can superimpose the daily pondage when we know  
 16 the effect of the weekly pondage.  
 17 (Slide 38) The required weekly pondage can be found  
 18 by using a simple mass curve. And all this is is the  
 19 running sum of all of the demand in the one case and  
 20 the inflow in the other case, and this is what's shown  
 21 on the figure.  
 22 The firm power is for the Kiru plant, so it's about  
 23 51.83 MW. So you're accumulating 51.83 MW per hour,  
 24 resulting in a total of 8,707 MWh at the end. The  
 25 cumulative power on the vertical axis is energy, so

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17:09 1 reduce generation on weekends to impound water for  
 2 weekdays, then other power stations would be required to  
 3 operate during the weekend to compensate what's missing  
 4 from this plant. This would be sub-optimal for the  
 5 overall system investments and may actually increase  
 6 the overall energy production cost. So while it may be  
 7 a decision that could be made, it's not an economically  
 8 sensible decision, and therefore not a realistic one.  
 9 (Slide 39) I come then to the Excel spreadsheet that  
 10 was provided to us.  
 11 (Slide 40) The calculation displayed the analysis  
 12 performed by India for the Kiru plant. Unfortunately,  
 13 this spreadsheet does not provide the rationale for the  
 14 computation of pondage. The load dispatch calculation  
 15 is done manually, without relying on formulas or logic  
 16 embedded in the spreadsheet itself. The user must  
 17 decide how much of the weekly flow volume will be  
 18 discharged in each of the days, and this volume is then  
 19 divided between an e-flow and a daily block loading,  
 20 with the power station operating at the rated plant flow  
 21 rate; that is, at the installed capacity.  
 22 For application, the user is required to determine  
 23 the daily distribution of the available flow volume  
 24 externally, and the hourly load is then calculated, also  
 25 externally, with no embedded formula, so that the

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<p>17:10 1 pondage does not go below the DSL in any hour. The 2 computation is to select the number of minutes and 3 seconds of operation that will release the required 4 daily volume. 5 Conditional formatting has been used to identify 6 instances where the water level goes below the DSL, but 7 the spreadsheet does not have the ability to make 8 adjustment other than by the user. 9 The approach of summarising the calculation in 10 a spreadsheet form can be useful to illustrate the 11 importance of the various parameters. 12 (Slide 40) When we have taken the sheet provided by 13 the Court, and it was populated with the data for Kiru, 14 and with an assumed operating mode, on examination of 15 the results, it's apparent that the underlying 16 assumption was that paragraph 15 is a governing design 17 criteria. This is apparent when one examines the weekly 18 variation of the pondage and the distribution of energy 19 among the days of the week. 20 As shown in the figures here, the weekend is used to 21 accumulate pondage close to the limit of what is 22 permitted by paragraph 15. And the associated energy 23 production is heavily weighted to the weekdays, with the 24 weekend daily production being about one third of the 25 weekday production.</p> <p style="text-align: center;">Page 233</p>	<p>17:13 1 4 to 12 hours of operation per day, consistent with the 2 discussion earlier today. And the figures here show the 3 weekly use of pondage, the energy production per day, 4 and the flow variation through the week. 5 Note that this operation gives exactly the same 6 energy as the version given in the original model, 7 although some gain would truly be possible because of 8 the lower head losses and better efficiency. These 9 factors are not accounted for in the model. 10 (Slide 42) As might have been expected, if the load 11 is equally distributed through the week, the pondage and 12 operating time is exactly as shown in this slide 13 earlier, based on a simple analytical relationship. 14 4 hours daily operation requires pondage of 15 3.5 million cubic metres, 8 hours requires 2.8 and 16 12 hours requires 2.1. This compares with the value of 17 10.1 from the analysis by India, which was clearly set 18 out to maximise pondage without practical constraints on 19 the assumptions. 20 (Slide 43) The spreadsheet was also adjusted to 21 include the parameters identified as being relevant to 22 the calculation. And this won't be very clear, but the 23 document has been provided to you. 24 These include the number of generating units on 25 outage, the number of units available, the best</p> <p style="text-align: center;">Page 235</p>
<p>17:11 1 Dispatch is also unreasonable, with peak duration of 2 one hour or less on the weekend days, and only 3 2.75 hours on weekdays. The dispatch assumes the plant 4 operates at full installed capacity, with no adjustments 5 for turbine availability or efficiency. 6 As discussed earlier, the dispatch conditions 7 assumed are not reasonable given the actual distribution 8 of demand through the week. The sheet indicates 9 an impractical dispatch with abrupt but short peaks, and 10 the operation would be extremely disruptive for dispatch 11 by requiring that other plants stop and start to 12 accommodate the short generating period available. 13 The conclusion is that this operating mode was 14 selected to maximise pondage, without any consideration 15 of the practicalities of operation within the power 16 system or the characteristics of the plant. 17 (Slide 41) So we used the same spreadsheet to 18 compute pondage under other assumed operating modes. 19 This was presented in Appendix E to the Second Phase 20 Memorial. In these options, the daily load was assumed 21 to be equal through the week, as is indicated by the 22 load curve data for the Northern Region Grid. We varied 23 the number of operating hours and the days to illustrate 24 a range of conditions. 25 The most practical options would be in the range of</p> <p style="text-align: center;">Page 234</p>	<p>17:14 1 efficiency point discharge, the minimum turbine flow 2 rate, the ratio of weekday to average daily energy, and 3 a provision to set the minimum practical daily peaking 4 time. 5 The spreadsheet defines the timing of the daily peak 6 by assuming that the plant could be use for the evening 7 peak, stopping at 11.00 pm. The number of daily 8 generation hours is computed and used to toggle the 9 plant on or off for the selected number of hours. 10 Note that the analysis was modified to use 11 contiguous hours, rather than requiring manual 12 adjustment to the minute and second as in the original 13 sheet. This was for simplification, for illustration, 14 but it is also a practical step. 15 The time when the peak occurs during the day is less 16 important than the duration of the peak. If the time is 17 the same on each day then there is no effect on the 18 pondage calculation itself. 19 A factor was included to set the weekday energy 20 larger than the weekend. And by allowing the weekend 21 energy to exceed the daily average energy, there was 22 an increase in pondage relative to the equal daily 23 assumption in the previous slides. 24 We have established the variation in energy based on 25 the actual load curve. However, this adjustment is</p> <p style="text-align: center;">Page 236</p>

17:15 1 small because the Northern Region Grid curve shows  
 2 a very small difference between weekends and weekdays.  
 3 In the case of a six-hour daily generation, the  
 4 weekly load curve increases pondage from 3.2 million  
 5 cubic metres for equal loading to 3.36 for the weekly  
 6 load curve.  
 7 Any of the options described here abide by the  
 8 constraints in paragraph 15 but they do not adopt  
 9 paragraph 15 as a design criterion. As I mentioned, the  
 10 weekly demand curve shows clearly that the weekend  
 11 energy production requirements are close to the demand  
 12 on [weekdays], albeit somewhat lower, and there is no  
 13 logical reason to impose a significant differentiation  
 14 in the production, other than the desire to maximise  
 15 pondage.  
 16 The pondage computed from the original spreadsheet  
 17 was 10.1 million cubic metres because it included a flow  
 18 variation close to the limits of paragraph 15, even  
 19 though the actual load of the power system does not  
 20 justify this variation.  
 21 (Slide 44) The figures here illustrate the variation  
 22 of the pondage through the week, and the distribution of  
 23 the energy with the adjusted sheet. The pondage  
 24 fluctuates daily, with the minimum being above zero,  
 25 which you see on some of the days: days 2 and 3,

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17:18 1 to flow volume, and peak flow to power, as the context  
 2 requires. This is achieved using the plant performance  
 3 characteristics, and input such as efficiency,  
 4 generating head and fluid properties.  
 5 Operation of the plant is important, as it affects  
 6 the time during which the energy is available on any  
 7 given day and can be dispatched as power. As we've  
 8 noted, a run-of-river power plant will typically operate  
 9 from a minimum of about 4 hours up to perhaps 12 or  
 10 16 hours, depending on the energy available. Shorter  
 11 operating times would not be reasonable for plant  
 12 dispatch in an integrated power system with a peak of  
 13 4 to 6 hours a day.  
 14 An assumption required at this step is when during  
 15 the day the plant will operate. In the end, this  
 16 assumption will not change the pondage, provided that  
 17 a consistent daily dispatch schedule is followed for  
 18 each day of the week.  
 19 The various inputs and parameters can be combined to  
 20 give a pondage required using a rather simple sheet, as  
 21 illustrated here. But importantly, the key input is the  
 22 weekly load curve, which is the Northern Region Grid,  
 23 with a modest difference between the average weekday and  
 24 average weekend loads. As such, this is a seven-day  
 25 analysis that is based on the reality of the load for

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17:17 1 I think. Most of the variation is due to the daily  
 2 variation in the power, which is based on six hours of  
 3 generation in this example.  
 4 The energy plot simply shows that the production  
 5 varies slightly among the days, as indicated by the  
 6 Northern Regional Grid load data. So the energy  
 7 production here matches what's in the load demand.  
 8 The variation varies day to day, and it is adjusting  
 9 the peak capacity with a fixed daily generation time.  
 10 (Slide 45) A simplified spreadsheet can also be used  
 11 to compute the pondage, including the effects of the  
 12 weekend-to-weekday variation, and the hourly variation  
 13 within a given day. And this is a quick model we put  
 14 together for this presentation. It just takes the key  
 15 inputs we have, which is the load in the power system  
 16 supplied by the plant. This should follow the Northern  
 17 Regional Grid system load; that appears in a column with  
 18 data. And it's adjusted to the average load equal to  
 19 the firm power for the plant. And firm power is of  
 20 course determined from the MMD.  
 21 The other key input is the characteristics of the  
 22 power plant, including its installed capacity and  
 23 associated rated discharge. And the pondage is  
 24 determined from the flow volume available for the load  
 25 variation, so the methodology must convert from energy

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17:20 1 the power plant.  
 2 This is a very preliminary model, pending various  
 3 checks to ensure valid results under all possible  
 4 operating conditions. However, the exercise shows that  
 5 a simple model, based on the analytical principles  
 6 outlined today, can be used to estimate pondage based on  
 7 load, capacity and generating duration.  
 8 (Slide 46) Coming back to the question of  
 9 Professor Minear earlier today: Baglihar.  
 10 On the left-hand side is the load curves provided by  
 11 India to the Neutral Expert for Baglihar. Those curves  
 12 were taken from one day early in December 2004, so  
 13 they're slightly out of the period that we selected  
 14 here, but in the vicinity.  
 15 On the right-hand graph, I've plotted the sequential  
 16 weekly load alongside the average 2004-2005 dry-season  
 17 load that we've used for the computations presented  
 18 today. There was a difference in the daily peaks, with  
 19 the evening peak being about the same but the morning  
 20 peak being smaller. The difference may be due to  
 21 seasonal changes in load weather, or perhaps some  
 22 unknown characteristics of that specific week.  
 23 When the Kiru HEP pondage is computed for this  
 24 one week, the total pondage requirement is 3.48 million  
 25 cubic metres, rather than 3.32 million cubic metres

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17:21 1 which we computed with all other parameters being the  
 2 same. The difference is because of the minor load  
 3 variation, and illustrates the natural variability due  
 4 to load uncertainty in a complex power system. In this  
 5 case, the difference in the pondage is less than 5% from  
 6 the average load curve calculation, and much lower than  
 7 the value of 10.1 million cubic metres computed by  
 8 India.

9 The small difference in the estimate when comparing  
 10 an average load curve with one specific week illustrates  
 11 that there can be some variability because of the  
 12 natural variability of the load. However,  
 13 paragraph 8(c) of Annexure D of the Treaty applies  
 14 a 100% safety factor to the amount of the pondage  
 15 estimated, which accounts for these minor differences in  
 16 the computation and for the variable inputs of the load  
 17 curves.

18 What is clear is that a very different load curve,  
 19 taken more than a decade earlier for one specific week,  
 20 does not produce a major difference in the pondage. The  
 21 use of the average load curve, as we have approached, is  
 22 consistent with the approach in the Treaty to generate  
 23 an averaged value of the MMD for computation of the firm  
 24 power, as opposed to performing calculations for one  
 25 specific week in the record.

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17:23 1 I don't know if that answers the question you had  
 2 earlier.

3 PROFESSOR MINEAR: Thank you, Mr Rae. I'm still a bit  
 4 puzzled that when the Neutral Expert in Baglihar  
 5 calculated pondage, he did, in his determination of the  
 6 load, perceive a lower load during the weekends than the  
 7 weekdays. And I'm not sure I see how that's reconciled  
 8 with what you said in this last slide.

9 MR RAE: Well, the truth of the matter is that the Neutral  
 10 Expert entered the calculation assuming that he would  
 11 apply paragraph 15. And then he set about to determine  
 12 daily peaks, within that general distribution from  
 13 paragraph 15, corresponding to the timing of the peaks  
 14 in these diagrams.

15 So there was an underlying assumption that  
 16 paragraph 15 applied as the overriding production  
 17 relationship of the pondage. He only used this to say:  
 18 well, there's a peak around 7.00 in the morning, so  
 19 I can have 7.00 in the morning some time, and a peak  
 20 around hour 20, I can put some at hour 20. And then  
 21 he adjusted the duration of those a little bit.

22 And the difference between what India did and what  
 23 the Neutral Expert did had to do with this slight  
 24 difference in the timing of those two peaks. But the  
 25 underlying assumption of both was the same: that they

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17:24 1 applied paragraph 15 of the Treaty.

2 PROFESSOR MINEAR: So does this take us back to the issue  
 3 that Sir Daniel raised earlier about the application of  
 4 paragraph 15, and how paragraph 15 is applied in this  
 5 context?

6 MR RAE: That's correct. And the interpretation of the use  
 7 of that, I would leave to Sir Daniel. But that is the  
 8 context. And certainly going back to the discussions we  
 9 had around pondage in Baglihar, the Neutral Expert was  
 10 clearly wanting to apply paragraph 15 as a primary  
 11 design criterion.

12 And as I illustrate, when we do the analysis with  
 13 just the power, we're coming out with numbers, in the  
 14 case of Kiru, around 3-point-something. When you're  
 15 applying paragraph 15, you're coming up with numbers in  
 16 the order of 10. So two thirds of the amount of pondage  
 17 is coming from the use of paragraph 15, which from  
 18 an interpretation standpoint they will comment on. But  
 19 for me, looking at it from a calculation perspective,  
 20 it's not consistent with what we see in the power  
 21 system.

22 And we don't see -- the Baglihar line is the blue  
 23 line in there; there's the gold one on top which we  
 24 have. And it has a different character, there is a bit  
 25 of a weekend and weekday difference, but it is not

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17:26 1 producing a significantly different amount of pondage.

2 That, to me, is a bit encouraging: it shows that the  
 3 methodology is reasonably robust, that you can change  
 4 the load curve and not come up with a dramatically  
 5 different answer. And that's valuable in its own right.  
 6 But this is doing a design based on the data itself  
 7 rather than a hypothetical assumption, which is to apply  
 8 some other criterion.

9 PROFESSOR MINEAR: Thank you, Mr Rae.

10 Just an observation: if we do decide that it's  
 11 useful to have the logbooks for Baglihar and you provide  
 12 an analysis of the actual operation compared to what  
 13 India projected, it would also be useful to have  
 14 a projection of what you are projecting based on your  
 15 methodology that you're using in Kiru today; the  
 16 scenario 5 I think is probably the most apt.

17 MR RAE: Yes. Well, the logbooks don't give a projection.

18 SIR DANIEL: We don't want to talk about the logbooks.  
 19 I just want you to understand.

20 PROFESSOR MINEAR: Yes, this is just an observation of  
 21 something that would be helpful to me. So I don't want  
 22 to go further than that.

23 With the Chair's permission, just one other quick  
 24 observation. I understand the calculations you did for  
 25 Kiru and the five different scenarios, as compared to

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17:27 1 what India provided to Pakistan. But it's interesting  
 2 that I think although India projected a maximum pondage  
 3 of 20 million, I think million cubic feet or million  
 4 cubic metres, it only designed for about half that.  
 5 MR RAE: Yes, paragraph 8(c) includes the doubling. So as  
 6 I stated earlier, any of the numbers I'm presenting  
 7 today are the numbers from the raw calculation, before  
 8 the doubling which is included in paragraph 8(c). So  
 9 when I say 10 here, that is doubled to give 20 in their  
 10 actual documentation.  
 11 PROFESSOR MINEAR: Yes, I understand that. But I believe  
 12 that when they showed the actual size of the operating  
 13 pool, apart from what they calculate as maximum pondage,  
 14 it was roughly half of what they calculated they could  
 15 have, which raises a question in my mind whether they're  
 16 truly trying to manipulate to maximise pondage.  
 17 MR RAE: I can't comment on their rationale for some of  
 18 this. I'm just looking at the evidence of what we see,  
 19 as we calculate it ourselves.  
 20 PROFESSOR MINEAR: Okay. I don't want to belabour that  
 21 point. Thank you.  
 22 THE CHAIRMAN: So, Mr Rae, we have several questions we want  
 23 to put to you and we have limited time. Your  
 24 presentation has been very clear, and my general sense  
 25 is you probably don't need to run through your summary

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17:30 1 some synergy between them, you're accounting for that  
 2 synergy going forward. And then you're producing  
 3 an optimal additional plants of the new plants plus  
 4 the existing plants, so that you're able to minimise the  
 5 cost of production and investment in the future.  
 6 So whatever we do looking to the future is based on  
 7 forecasts. And you know yourself, we don't do only one  
 8 forecast; we do several. But then you're projecting the  
 9 different generation expansion plans forward, and each  
 10 of those we're coming back and computing a cost for.  
 11 But the plant that you have today is available in the  
 12 system and valuable to the system based on its economic  
 13 analysis of that day.  
 14 Now, the other thing to remember is that its  
 15 capabilities are being utilised in the system at the  
 16 time you bring it in, and it has value, and it will  
 17 continue to have that value in the future. And these  
 18 systems do evolve, but they don't change through  
 19 step-changes; they're gradual changes. And plants tend  
 20 to evolve, and you may change your operation a little  
 21 bit. But the investment is still valuable, whatever  
 22 it is.  
 23 PROFESSOR BUYTAERT: Thank you.  
 24 Another question relates to the load curves.  
 25 Indeed, you showed very nicely the load curve of the

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17:29 1 points. Although we do have the slides: if there are  
 2 particular issues there you'd like us to focus on, that  
 3 would be fine.  
 4 But let me first go to Professor Buytaert with his  
 5 questions.  
 6 PROFESSOR BUYTAERT: Thank you, Mr Chairman. And thank you,  
 7 Mr Rae, for indeed a very clear presentation. I've got  
 8 quite a few questions, but I'll try and be concise.  
 9 Let me start with one that I asked earlier to  
 10 Dr Miles about how to take into account any future  
 11 changes in the entire system, given that an average  
 12 plant will be around for several decades. Can you shed  
 13 some more light on how you would go about accounting for  
 14 those changes, and the implications for the need of  
 15 pondage?  
 16 MR RAE: I can give you a general perspective on this, and  
 17 that is that in doing generation expansion planning,  
 18 we're always looking at the power system as it exists  
 19 today and how it serves the load of today.  
 20 We then have a projection of what the load will be,  
 21 which will include, potentially, a change in the load  
 22 duration curve to some degree. And from that projection  
 23 we then look at what marginal plants you have to add to  
 24 the system so that the marginal plant changes  
 25 the capability of the existing plants. So if there's

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17:32 1 entire Northern Grid, but of course the pondage is  
 2 calculated on the load that will be assigned to that  
 3 plant.  
 4 And clearly the variation in the overall demand is  
 5 one factor, but there's many other operational factors  
 6 that come into play, including the distribution within  
 7 that grid, but increasingly you're also accounting for  
 8 the variability in supply. And there we're thinking  
 9 particularly about renewable sources: wind, solar.  
 10 I think the statistics you gave at the start show that  
 11 that's a very substantial part of the supply that needs  
 12 to be compensated. And hydropower of course has the  
 13 advantage of being extremely flexible, one of the most  
 14 flexible types of production.  
 15 Could you see that that's not playing a role in  
 16 India's calculations? Or should that be taken into  
 17 account when you look at daily and weekly variations:  
 18 again, that link between the overall regional load curve  
 19 and how a load curve is assigned to a particular plant?  
 20 MR RAE: We have to separate the load curve, being the  
 21 demand of the system, from the production of energy.  
 22 And what you're alluding to is how you get to the idea  
 23 of hybrid operation of hydropower with emerging  
 24 renewable sources; solar and wind, predominantly.  
 25 The key factor there is to consider what is the role of

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17:33 1 hydropower as an ancillary service provider to those  
 2 energy sources.  
 3 Hydropower does have a role, and it's a useful role.  
 4 But we have to recognise that run-of-river projects  
 5 actually have a fairly limited capability to do hybrid  
 6 operation, primarily because the amount of energy  
 7 storage is limited by the hydrology. Quite apart from  
 8 the pondage, energy storage is limited by hydrology:  
 9 you can't get more than what's available in the pondage.  
 10 In the summer period, during the high-flow period of  
 11 the year, run-of-river hydro has no energy storage  
 12 available to you, so it doesn't provide any ancillary  
 13 benefit to the solar. So some other plants [that] are  
 14 operating provide that energy storage complement to  
 15 solar in the summertime, in the high-flow period, and  
 16 that same plant is still available in the dry period of  
 17 the year, when, granted, there is more solar available  
 18 in the dry period than in the wet.  
 19 But still, if you look at the whole-system basis,  
 20 hydro is not the only solution to this. And what we're  
 21 seeing in other systems is a lot of expansion in the use  
 22 of battery energy storage and the use of pumped storage  
 23 as being a much more flexible use of energy storage than  
 24 what is run-of-river hydro.  
 25 Run-of-river hydro, whatever the hydrology is of

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17:36 1 But the end of the demand is about the same, at about  
 2 11.00. So your hydro generation is then concentrated  
 3 between 5.00, when the sun is starting to go down, and  
 4 11.00, which is about six hours. So your six hours of  
 5 daily generation that I talk about is in that period.  
 6 So you're still using it, it's still a value, and if  
 7 you've got pondage for six hours, that's where you're  
 8 using it.  
 9 In the dry season, you're getting some ancillary  
 10 benefit if you operate that plant continuously during  
 11 the day. So there's -- I'm a bit disconnected here, but  
 12 there's several revenue streams available for hybrid  
 13 operation of hydro.  
 14 One is the energy shifting, and that's the six-hour  
 15 evening peak that you can get money out of.  
 16 The other benefit is to give spinning reserve  
 17 capability and frequency control capability to  
 18 complement the solar. But in order to give that, that  
 19 hydropower plant has to be operating at the same time as  
 20 the solar and you have to have a certain amount of hydro  
 21 operating continuously during that period in order to  
 22 get that benefit, and that's the one of frequency  
 23 control. So if a cloud goes by, you get a reduction of  
 24 solar and you get little fluctuations in the power  
 25 system, and your hydro can react to those, provided it's

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17:35 1 that day, that's your maximum energy storage, is that  
 2 hydrology. So it actually has a very small impact when  
 3 you start talking about thousands of megawatts of solar  
 4 entering the system.  
 5 Keep in mind that in India there is more solar  
 6 generation capacity now than there is hydropower, and  
 7 there's no way that the available hydropower can  
 8 integrate all of that solar; it's just not physically  
 9 possible.  
 10 PROFESSOR BUYTAERT: No, but it can contribute --  
 11 MR RAE: What India is doing is they're investing large  
 12 amounts into pumped storage, and pumped storage is the  
 13 more flexible part because (1) it consumes the surplus  
 14 storage at the middle of the day, enabling other plants  
 15 to remain in operation in the base; and it then  
 16 dispatches that into the evening hours.  
 17 Your pumped storage plants will tend, in a solar  
 18 system, where you have this sort of a peak solar during  
 19 the day, which produces -- the rest of the system drops  
 20 down the middle. We did provide you a figure  
 21 illustrating that in our presentations in 2024 from the  
 22 State of California and it's in the record.  
 23 But what it means is that the peak will tend to be  
 24 provided by the solar, the daytime peak, and it will  
 25 then move all of the hydro generation into the evening.

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17:38 1 operating.  
 2 And what that will tend to do with run-of-river is  
 3 mean that you want to bring them on when the solar  
 4 starts, keep them operating for part of the day, and  
 5 whatever pondage you can accumulate you'll discharge in  
 6 the evening, but you will have had a continuous part  
 7 plus a block at the evening, and that will actually  
 8 reduce the net amount of pondage that's required.  
 9 PROFESSOR BUYTAERT: The point I'm trying to make is that  
 10 you focus a lot of attention on the smoothing out of  
 11 demand, particularly between weekdays and weekends, but  
 12 I can see certain situations where indeed the additional  
 13 of solar power, and particularly wind, might, for  
 14 example, induce stronger variations on a weekly basis,  
 15 which I can imagine India might want to use hydropower  
 16 as a way to account for that variation and still need  
 17 a weekly or multi-day accumulation and release that is  
 18 not reflected in the regional demand curve.  
 19 MR RAE: The requirements for multi-day storage of energy to  
 20 complement low periods of wind or low periods of solar,  
 21 that's beyond the scope of what projects can do in  
 22 a run-of-river sense. There's simply not enough energy  
 23 storage available, especially for a large solar system,  
 24 which you now have in India.  
 25 PROFESSOR BUYTAERT: Good. Thank you. I think I'll leave

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17:39 1 that question --  
 2 MR RAE: I recognise that ideally one looks and says: well,  
 3 hydro can do everything, but it can't. It's got a very  
 4 limited capability. And the part of hydro that has  
 5 a significant capability is building out the pumped  
 6 storage projects, which are built -- Snowy Mountains  
 7 I think is 12 days or something of storage. It's quite  
 8 long: it's over a week of energy storage being built in  
 9 with a couple of thousand megawatts. And India is  
 10 working towards the same thing.  
 11 DR BLACKMORE: \$12.2 million worth.  
 12 PROFESSOR BUYTAERT: Good. In the interest of time, I'd  
 13 like to move on to another question.  
 14 I think when referring to what Dr Miles mentioned  
 15 earlier, I think he used the word "entitlement" to  
 16 refer to paragraph 15, as if India might feel entitled  
 17 to make maximum use of those boundaries.  
 18 In your analyses, have you done a calculation or  
 19 seen how far India could push? For example, if  
 20 they really would want to design a synthetic or  
 21 a hypothetical load curve that maximises the calculation  
 22 of pondage only within the limits of paragraph 15, for  
 23 example, for Kiru, what would be that volume of maximum  
 24 pondage if it were only to be constrained by  
 25 paragraph 15?

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17:42 1 water and Pakistan made a counter-suggestion of  
 2 a release table of water. The method they used then, is  
 3 that still Pakistan's position of how that really should  
 4 be calculated, or has that position moved on since the  
 5 Baglihar Neutral Expert proceedings?  
 6 MR RAE: Well, we've moved on position, because of course  
 7 we have your own Award, which has changed conditions.  
 8 So we're trying now to interpret the information  
 9 provided in the Award with what's in the Treaty, so that  
 10 we present basically what I'm saying today: that that's  
 11 the load of the system, and you've ruled that the load  
 12 is important, so we've included that; that gives us the  
 13 seven-day pondage. And we've allowed for the daily  
 14 pondage, or the daily fluctuation within it, subject to  
 15 a block loading, which is similar to what India has done  
 16 in the past. But we are just conditioning it, saying  
 17 that it's got to be within the realm of what is  
 18 physically reasonable and practicable for a power  
 19 system.  
 20 And in a major power system, can you imagine someone  
 21 saying, "I want to bring a plant on for one hour of  
 22 1,000 MW"? It just doesn't happen that way.  
 23 PROFESSOR BUYTAERT: Thanks.  
 24 One last question, going slightly back to what  
 25 I mentioned earlier, but also taking the US ACE

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17:41 1 MR RAE: Well, this is the number that comes out, which is  
 2 10-something. And actually I think the spreadsheet  
 3 you gave doesn't quite go all the way to the limit. So  
 4 something in excess of 10 million cubic metres, compared  
 5 with the amount of 3-something for the actual load  
 6 curve.  
 7 PROFESSOR BUYTAERT: I think that 10 is what eventually  
 8 they built. 20.22 I think is what they --  
 9 MR RAE: It's not built yet.  
 10 PROFESSOR BUYTAERT: Let me have a look at the numbers.  
 11 MR RAE: They come with 20, because they do the amount  
 12 calculated, then you double it, giving your safety --  
 13 PROFESSOR BUYTAERT: Yes, India's pondage is 20.22,  
 14 isn't it?  
 15 MR RAE: Yes.  
 16 PROFESSOR BUYTAERT: But I can imagine that you can tweak  
 17 the hypothetical load curve further to increase that  
 18 number of pondage without being outside of the  
 19 boundaries of paragraph 15.  
 20 MR RAE: A little bit, because they are effectively using  
 21 paragraph 15 as the design criterion. Yes, they are  
 22 more or less at the limit of it.  
 23 PROFESSOR BUYTAERT: Okay, yes. Thank you.  
 24 Yes, staying with Baglihar, in the Baglihar Neutral  
 25 Expert proceedings, India proposed a table of release of

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17:44 1 definition of "firm power" as all about the agreed  
 2 portion of the load requirements that are put upon that  
 3 power plant.  
 4 What kind of evidence -- and perhaps it's more  
 5 a question to your legal colleagues -- but what amount  
 6 of evidence would India have to provide to show -- in  
 7 some ways they can say it's simply what the plant  
 8 operator has agreed will be dependable power to be  
 9 provided. How much evidence needs to be provided for  
 10 that agreement of what the role of that specific plant  
 11 will be in that broader grid, taking into account, for  
 12 example, a desire to compensate for renewables, as well  
 13 as variations in the demand?  
 14 MR RAE: It is important to realise that the Northern Region  
 15 Grid does not include only this Indus Waters system.  
 16 The Indus Waters system is actually a small part of the  
 17 total generation of the Northern Region Grid. So to the  
 18 extent that they're building in other renewable  
 19 energies, which tend to be further south because it's  
 20 more appropriate from a climatic standpoint, you need to  
 21 have energy resources close to those for managing the  
 22 load of a solar plant.  
 23 You don't want to put a solar plant somewhere here  
 24 (indicating), with 1,000 or 2,000 MW, which is the scale  
 25 they're going, and then to try to put in projects

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17:45 1 1,000 km away that are going to try to provide the  
 2 ancillary benefits, because by doing that, you're  
 3 building in tremendous additional transmission costs to  
 4 connect the two of them, and it's just not physically  
 5 practical or economically sensible.  
 6 So in terms of what information would be shared, the  
 7 information is: what is specific for the power station  
 8 and how it reacts to the load itself. But the load  
 9 within the context of the overall load -- again, we're  
 10 not isolating and saying that this one plant does  
 11 everything for the system. It does a part of the  
 12 integrated load in the whole system. So if it has  
 13 a certain amount of power and energy capability, its  
 14 ability to supply that within the overall tells us how  
 15 it operates. But it has to still operate within the  
 16 constraints that it has locally. It's not a blank sheet  
 17 that you get to start with here.  
 18 SIR DANIEL: If it would be helpful -- Professor Buytaert,  
 19 you indicated that perhaps that was a question also for  
 20 legal colleagues. We'll come back to that tomorrow.  
 21 PROFESSOR BUYTAERT: Great, thank you very much.  
 22 Good. I think I'll leave it at that. Thank you.  
 23 THE CHAIRMAN: Professor Minear.  
 24 PROFESSOR MINEAR: Just one quick question. Are there other  
 25 hydropower plants in the Northern Region that are not

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17:48 1 I'm not myself overly familiar with that issue. And  
 2 if I was to just base my thoughts on the site visit, it  
 3 seemed like you opened the gate and the water flows and  
 4 the turbines start turning; and you close it and things  
 5 stop. But I understand that that's perhaps overly  
 6 simplistic.  
 7 Can you say a few words about why you think that  
 8 amount of time is a significant factor that needs to be  
 9 added into the calculations.  
 10 MR RAE: I would start by saying it's a secondary or  
 11 tertiary factor anyway. But what it means is that the  
 12 plant can't actually go immediately zero to 100% load in  
 13 zero seconds. That doesn't happen. In effect, you are  
 14 able to start turbines in a matter of a few minutes, to  
 15 go from zero to full load. But you typically won't want  
 16 to start them all at the same time, because you have to  
 17 manage fluctuating pressures upstream in the waterways  
 18 and the like. So there are various technical reasons  
 19 why you want to stretch that out a little bit.  
 20 That's for the plant itself. But when it comes to  
 21 the load -- if you could bring up the daily load  
 22 curve -- you can see the load varies as you're  
 23 increasing. And there's 10,000 MW per step going up,  
 24 but still, you would tend to start the unit at its  
 25 minimum discharge, and it then starts supplying the

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17:47 1 subject to the Treaty constraints, so they can be  
 2 operated more flexibly than the plants that are subject  
 3 to those constraints?  
 4 MR RAE: Yes, there are. And I would refer to Mr Mehar, who  
 5 could give you more detail on those. But there  
 6 certainly are, on other river basins that are not part  
 7 of the Indus system.  
 8 SIR DANIEL: I think again that we can come back to that  
 9 tomorrow, because in our Memorial in the First Phase we  
 10 gave quite a detailed description of the region. So,  
 11 Professor Minear, we'll certainly come back with those  
 12 details tomorrow.  
 13 PROFESSOR MINEAR: Thank you very much.  
 14 MR RAE: And keep in mind, any pumped storage project being  
 15 considered in India is outside of the remit of this  
 16 Treaty altogether.  
 17 THE CHAIRMAN: So, Mr Rae, just two or three questions from  
 18 me.  
 19 Ultimately, in the dispositif as Pakistan presented  
 20 it to us, and as might be revised tomorrow, there's  
 21 a sense that the Court might indicate factors that need  
 22 to be taken into account. One of those factors is  
 23 ramp-up and ramp-down time, which you did in passing  
 24 refer to in your presentation. I think you referred to  
 25 18 minutes as one possible period of time.

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17:50 1 load. But then as the demand in the system increases,  
 2 you let the load in the plant increase. So it follows  
 3 the load up until it reaches the amount that you want to  
 4 discharge or generate out that day.  
 5 So there's going to be a natural point of load  
 6 following, followed by uniform set point, followed by  
 7 a load following on the reduction. And that tends to  
 8 round out the generation.  
 9 It's not the biggest effect on pondage, to be  
 10 honest; it is secondary.  
 11 THE CHAIRMAN: That's what I'm getting at: how material is  
 12 it really in the bigger picture of determining pondage?  
 13 MR RAE: It's just conceptually we're offended by this idea  
 14 that you've got a plant that comes on and operates for  
 15 less than an hour at however many hundreds of megawatts  
 16 instantaneously, and someone presenting that as  
 17 realistic. In the way we're saying that projections  
 18 must be realistic, well, let's make them that. And that  
 19 means you don't have this kind of abrupt steps.  
 20 THE CHAIRMAN: Turning to a different type of factor,  
 21 I think earlier in the presentation you indicated that  
 22 transmission over long distances is an issue when you're  
 23 engaging in a grid. As one of the factors one should be  
 24 taking into account when thinking about pondage, is the  
 25 distance of the HEP from the grid, or from other HEPs

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17:51 1 that are supplying the grid, something that also should  
 2 be taken into account, even if a lesser factor? Or is  
 3 that not the case?  
 4 MR RAE: I would leave it to our legal team. But the Treaty  
 5 doesn't say anything at all about transmission.  
 6 I made that comment only in the illustration that  
 7 you don't have all of your solar in one place, and your  
 8 hydro you think is working in hybrid with it located  
 9 very far away, because you've got to generate -- or  
 10 transmit that back and forth.  
 11 In effect, when we're running these hydro plants on  
 12 the Indus River, they're in a cascade down the river,  
 13 and the transmission is built to them and is then  
 14 supplying into the grid. There is a great deal of  
 15 sophistication that goes into planning the connection of  
 16 transmission lines, and I would hesitate to get into  
 17 today. But I don't see it as a constraint for what we  
 18 do.  
 19 THE CHAIRMAN: I just ask because ramp-up/ramp-down is also  
 20 not in the Treaty, but you're advancing it as a factor  
 21 that we should be taking into account. I'm just asking:  
 22 is distance of the HEP from the grid also a factor or  
 23 not, in your mind?  
 24 MR RAE: I'm advancing it to say that the other factors  
 25 you suggested should not be considered, which is the

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17:55 1 calculating pondage. And of course the Court will want  
 2 to be sure if it does something of this type, it's not  
 3 excluding factors that should properly be within the  
 4 ambit of how one might attempt to calculate the  
 5 necessary pondage.  
 6 So I'm just speculating, without any knowledge as  
 7 a hydro engineer, what those factors might be, and  
 8 encouraging you to reflect on it overnight as well for  
 9 the purposes of tomorrow.  
 10 MR RAE: We'll reflect on it. There's always the tension of  
 11 what we're trying to do in review of projects versus  
 12 what is happening for the design of projects, and  
 13 there's a difference between the two. That's important.  
 14 THE CHAIRMAN: Yes. Okay. Thank you very much.  
 15 I do realise we did not give you time for your  
 16 summation, but again, we've got the slides, and we also  
 17 had a very clear presentation from you. Unless there's  
 18 any particular points you wanted to stress before I let  
 19 you go ...  
 20 MR RAE: No, I think that covers it.  
 21 THE CHAIRMAN: Okay. Well, then it just leaves for me to  
 22 thank you very much, Mr Rae --  
 23 MR RAE: Thank you.  
 24 THE CHAIRMAN: -- for the very helpful presentation and for  
 25 answering the questions that we had.

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17:53 1 operation of other remote power systems, or power  
 2 supplies, thinking that they are in a hybrid mode with  
 3 this one. If you want to have a hybrid solar with this  
 4 plant, the solar has got to be there at the same  
 5 location. They're co-located.  
 6 THE CHAIRMAN: And then I guess my final question is whether  
 7 the concept of the overall stability of the grid is  
 8 a factor that would be taken into account in making  
 9 these calculations. Again, if ramp-up/ramp-down is in  
 10 it, is overall grid stability to handle different kinds  
 11 of circumstances that might unfold something that you  
 12 should also be including in your list of factors or not?  
 13 MR RAE: I will consult with Sir Daniel on this. The only  
 14 thing I would say is that I am sure India has quite  
 15 a lot of very bright people dealing with the power  
 16 system stability aspects on an ongoing part, as does  
 17 every utility in the world. And this, we'll comment on  
 18 whether it's applicable as part of the response  
 19 tomorrow, but it's something which is done, and has not  
 20 been an issue that Pakistan has raised up to this point  
 21 in time. But we'll comment more tomorrow.  
 22 THE CHAIRMAN: Well, that's fine. I think it's just  
 23 something that you and counsel will want to be thinking  
 24 about, because you are asking us to indicate what are  
 25 the factors to be taken into account for purposes of

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17:56 1 I think we are at the witching hour. The Court is  
 2 going to retire to our room to ponder whether there are  
 3 any questions that we didn't have the chance to ask that  
 4 we would like to ask.  
 5 Perhaps, Sir Daniel, I just put to you a question of  
 6 a general nature. In the event that we feel we've asked  
 7 the questions we want, is it useful to do nothing more,  
 8 or is it helpful to you to have a written list of  
 9 questions that we might have asked during the course of  
 10 the day that you said, "We'll pick that up tomorrow", or  
 11 you maybe answered, but maybe didn't answer as full as  
 12 you wanted to? Because the Court is prepared to be  
 13 helpful in that way by giving you something in writing  
 14 in the next hour or two, if it's helpful to you.  
 15 SIR DANIEL: Thank you, Professor Murphy.  
 16 I think realistically, unless you've all been  
 17 keeping a written note of your questions -- and some of  
 18 them were extemporaneous -- we're probably dependent on  
 19 Mr McGowan, because we will simply go through the  
 20 transcript; we've been making our own note of it. So  
 21 I don't think that we need to ask the Court to spend  
 22 more time going itself through its own recollections.  
 23 We can do that.  
 24 I should say that there are undoubtedly points that  
 25 we will wish to come back to throughout the course of

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17:57 1 the day. I think we've given you provisional answers,  
 2 sometimes fuller answers on some questions, but we've  
 3 reserved the thinking time between now and 1 o'clock  
 4 tomorrow.  
 5 But no need for you to send us anything more in  
 6 writing.  
 7 THE CHAIRMAN: In that case, we will retire. If there are  
 8 any questions that we did not ask that we think it might  
 9 be helpful for you to address, then we will convey that  
 10 to you in short order so that you can factor that into  
 11 your preparations for tomorrow. We will also contact  
 12 you if we've reached a conclusion that we don't have any  
 13 further questions, just so that you know not to expect  
 14 something.  
 15 Otherwise, I think we'll then be resuming tomorrow  
 16 at 1 o'clock.  
 17 SIR DANIEL: Mr Chairman, one last point does come to mind,  
 18 and I raise it not in request or in expectation, but  
 19 just so that it's not forgotten.  
 20 We had that little exchange earlier on about our  
 21 reading of the various paragraphs of your award  
 22 addressing the place of paragraph 15 in the calculation,  
 23 and I invited you from the podium to give any  
 24 clarification that the Court felt may be warranted.  
 25 You, just as we commenced this afternoon, came back

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18:01 1 THE CHAIRMAN: Very good.  
 2 In that case, again, thanks to all the counsel and  
 3 representatives today for the very helpful  
 4 presentations. The Court is aware that this is not  
 5 easily put together and presented, and we're very  
 6 grateful for not just the oral presentations but the  
 7 slides which we have, and will no doubt make  
 8 reference to.  
 9 I would wish you a pleasant evening and morning, but  
 10 I know that you'll be working hard, and we appreciate  
 11 that very much. We will look forward to seeing you  
 12 tomorrow here at 1 o'clock. Thank you.  
 13 SIR DANIEL: Thank you very much.  
 14 (6.02 pm)  
 15 (The hearing adjourned until 1.00 pm the following day)  
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17:59 1 and referred us to paragraphs 680 and 681 of the General  
 2 Issues Award and paragraphs 40 and 45 of the  
 3 Clarification Decision. And I don't have the transcript  
 4 in front of me, but my recollection is that you said  
 5 that you thought that those encapsulated the position  
 6 fairly well, and my recollection is that those included  
 7 some of the paragraphs that I referred the Court to in  
 8 my opening submissions. And then you said something  
 9 along the lines of, "I haven't heard anything from  
 10 Pakistan which is inconsistent with those paragraphs".  
 11 So I'm simply going to invite the Court: if there  
 12 is, in the light of this afternoon's submissions, any  
 13 point going to our understanding of where paragraph 15  
 14 is in the firmament of the process, that would be  
 15 helpful to have from you in writing so that we can  
 16 actually grip that issue tomorrow.  
 17 THE CHAIRMAN: So I understand you're inviting us to take  
 18 a look at that. The Court will consider the matter.  
 19 I do think that what I said earlier reflects where we  
 20 are, so I'm not sure we will have anything further to  
 21 say to you, but we will certainly ponder it as we  
 22 retire. And perhaps you can also reflect overnight on  
 23 what I said, to see if it is the case that you feel you  
 24 need something more from us.  
 25 SIR DANIEL: Thank you. We will do.

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ARBITRATION PURSUANT TO ARTICLE IX AND ANNEXURE G OF THE INDUS WATERS TREATY 1960

Day 1 -- Hearing on the Second Phase on the Merits

Monday, 2 February 2026

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ARBITRATION PURSUANT TO ARTICLE IX AND ANNEXURE G OF THE INDUS WATERS TREATY 1960

Day 1 -- Hearing on the Second Phase on the Merits

Monday, 2 February 2026

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ARBITRATION PURSUANT TO ARTICLE IX AND ANNEXURE G OF THE INDUS WATERS TREATY 1960

Day 1 -- Hearing on the Second Phase on the Merits

Monday, 2 February 2026

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