[SQUEAKING]

[RUSTLING]

[CLICKING]

RICHARD DE NEUFVILLE: Right. So it's about this particular plant here, which is a desalination plant. I prefer to call it desalting, because salination implies that you're actually going to the effort of putting salt in the water, which you don't have to. So it is a huge plant. It's one of the largest desalting/desalination plants in the world.

And it was built in Victoria, which is a southern state of Australia, whose capital is Melbourne. And it is a mega plant. It has a capacity of 150 billion liters a year. And interestingly, it was built in three modules.

So the modules here are 50 billion a year, but they were built all at once. The capital cost was 3.5 billion Aussie dollars, which is something around $2.5 billion US. It's a big project, started in 2009, completed in 2012.

And it was what they call a public/private partnership. That is, it was built by private investors who fronted up the capital. And it's designed to guarantee supply through 2039. So it was built with a 30-year forecast in mind.

So this is an example of a massive initial investment to meet maximum forecast over 30 years. Maximum forecast-- driven by two things, generally. One is by the increasing population of Melbourne itself, as a very attractive and interesting city, very lively. I recommend a visit to anyone.

I worked for the airports there. And also because of increasing effect of climate change leading to plausible increased periods of drought and low water in the reservoirs. So a 30-year forecast. Now, let's think about the economics about this.

So what happens is, they build the plant. And they keep it on tap. They maintain it.

But they don't deliver any water until the water authorities of the state of Victoria and the water board that they have there ask for some. So in 2016-- that is 4 years after the opening-- they placed an order for 50 billion. Liters that is 1/3 of the capacity.

Two years later, they put in an order for less than 50 billion. And just this year-- that is, starting in April, but basically into the summer season, which is what we think of fall, winter, and spring-- they wanted 50 more billion. So here, what you have is a huge investment that is-- so nothing, there's no return on the first three years, because it's under construction.

Then, for the next four years, nothing happens. The first order is for 1/3 of the total capacity. The next 2 orders are for at least 1/3 the capacity, but we haven't gotten anywhere near the full capacity.

So it poses the question-- should they have phased the modules over time? So far, only 2/3 the Capex has not been needed for a decade, roughly speaking. So what do you think? What are your reactions to this?

Now, they could say, well, a crisis could occur any time, et cetera, et cetera. But what do you think? Any thoughts or comments about this? OK, yes, go ahead.

AUDIENCE: Oh. It's not a question. I was just going to say that that's an example of, the forecast is always wrong.

RICHARD DE NEUFVILLE: Well, I don't know if the forecast was wrong. Because the forecast wasn't timed. They basically forecast the maximum possible demand. And we don't know if that was wrong.

But it's uncertain. So they knew it was uncertain, but the implications might have been, well, if it's going to go up to a need 150 over all that time, maybe they should have done it incrementally. The forecast might be right.

They might need as much as the maximum at some time. So hard to say. Just like fire escapes or emergency exits from a building, they may never be used. Doesn't mean it wasn't a good idea.

So having extra capacity you don't use is not necessarily bad. But there's money involved in this. And there are other ways to deal with low water levels. Having a desalting plant is a pretty special thing.

There's water rationing and other kind of things. So it's an issue. Was this a good investment, is the question I'm throwing out there. Joshua, go ahead.

AUDIENCE: Hey. Good morning, Professor. So are you saying that they have capacity for 96 billion liters, but they're only really using 50 billion liters?

RICHARD DE NEUFVILLE: I said they had capacity for 150 billion.

AUDIENCE: Oh, after construction this year in 2020?

RICHARD DE NEUFVILLE: No, the capacity was all built, as you can see on the slide now. That was opened in 2012. For the first four years, this thing didn't do a thing. That's not necessarily bad.

I have life insurance, and I haven't died yet. So I'm pretty happy about that. But still, it was a very large-- and for the first decade, depending on when you start-- that is, until 2020-- they've only used up to 1/3 of it, which happens to be just one of their module's capacity. Are we talking the same language, or am I--

AUDIENCE: We are. I thought it was construction that they built it, but they still only had a need for 50 billion liters. But I would agree. I think that they probably overshot and could have built incrementally and saved a considerable amount of money.

RICHARD DE NEUFVILLE: At least in terms of net present value terms. Yes. That's what I'm thinking of. Now, it turns out that the investors aren't having a hard time, because they're getting paid.

The city is paying for them, because they have invested all that money. And it's also possible they'll never use the water. So they had a deal where the city actually pays them about 600 million a year just to keep the plant alive, and to pay for the interest, and the depreciations, and so forth. So the investors haven't hurt.

But if it's too much construction, it means that the city of Melbourne and the state of Victoria have overpaid. So too much is investment. But the private investors, I think, are doing fine. Other comments, did you say, Indra?

AUDIENCE: Yeah. There are quite a few. Ali next.

AUDIENCE: Yeah, Professor. So I was thinking of the trade-off between first, building the flexibility and then the exponent that is a variable for the economies of scale. So about just the economics-- but then, as you said, sometimes, for big infrastructure, we're being paid for just having the capacity.

RICHARD DE NEUFVILLE: Yes.

AUDIENCE: So but also, there can be political reasons behind it, et cetera. So this is way beyond the economics.

RICHARD DE NEUFVILLE: Well, that's right. The at the drought when they ordered this, about 15 years ago, the local minister, the leader of the state saw this as a good thing. He was being very prudent.

And those jobs-- and a lot of people were happy about it. The press, until about 2014, was very against, because there was this huge investment. For a relatively small area, this is a huge amount of money.

And it was absolutely in mothballs, or it was just maintained, kept alive at a cost of over 600 million dollars a year paid by the citizens of Melbourne and Victoria for this. So they were less happy with that. Yeah, I can't give you more of the details.

But I'm just posing the question. Here it is. And what's remarkable about this case from my perspective is that in fact, the modules of 50 billion were part of the design. These are some of the most massive desalting plants available at the time.

So they felt they were already pushing the capacity for the-- it's a reverse osmosis approach. So you could easily think that maybe building 100 billion capacity in the first phase might be good. And then, if you really were getting more demands for it, maybe you have another module later on.

So that's the question I wish to put out on the table. I think I'll take one more question. Then, we'll go to the presentation. Indra?

AUDIENCE: We have Jeff next.

RICHARD DE NEUFVILLE: Jeff, go ahead. This is the last one. I'm glad to talk about it later on, but for now, Jeff, go ahead.

AUDIENCE: Yeah I just have two thoughts. One is, I've been thinking about this previously, too-- and I don't know how it works in the Australian government. But the federal contracting process is so long and tedious that I feel like building flexibility to add onto a project later on might be a preventative measure, and just building the capacity all up front makes more sense. And the second is, if they built the big capacity, it could have been dependent on how the environmental factors were, then-- a drought in 2008 or whenever.

RICHARD DE NEUFVILLE: Yeah. Well, I have a number of former students working in the government, particularly in the military, for procurement. And part of their design is this. So right now, one of our students, Jason Bartholomay, who's running a huge missile project out in Utah, is basically setting up the whole program with having the bidders right at the start bid on the project in terms of demonstrating their flexibility.

So they're baking it into it rather than coming at it and rethinking the procurement process in 5 or 10 years of making that a condition from the start. And I think that's an important part of having the flexibility, is that you bake it into it. And for those who're taking the full semester course, that will be one of the issues we want to deal with. How do you go from having a good idea to implementing it properly?