

[SQUEAKING]

[RUSTLING]

[CLICKING]

SPEAKER: Very, very happy. Actually transitions beautifully to Don Lessard's conversation on business models for deploying and how to get that upfront cost spread out. And, Don, as I've done all day, you are much better off introducing yourself and all of your history than I.

DON LESSARD: I'll be brief on my history. I'm Don Lessard. I'm an extinguished professor at MIT. 51 years in the Sloan School. My claim to fame, I guess here, I was one of the two faculty leaders on the energy minor that we built across all five schools, which was really, really one of the most fun experiences at MIT. I also, once upon a time, I taught finance, and I came to realize this is largely about financial engineering-- not largely, but financial engineering is overwhelmingly important here.

OK, I'm going to take just a little tiny slice of Nikki's presentation, which is fantastic. Determining appropriate pricing that balances utility investments with customer usage. So to me, that's the business model. All this other stuff is everything you need to do to get there. It's terribly-- even that piece is complicated enough, so let's just focus on that one.

Problem-- high capital cost, but your all-in monthly costs has to come out about the same as the current all-in monthly cost of gas plus electricity. Otherwise, it's dead in the water. If you run current costs of geothermal like even your second stage of your pilot through current utility models, it costs 2x at least. So it's 2 to 3 times as expensive as it needs to be to meet the cost, right?

Now, how do we get there? Well, this is my whole presentation. I have 17 more slides, but this is the whole presentation. Let's see.

So high capital costs, that's our issue. We are replacing iceboxes with refrigerators. We don't have to buy the ice every day, but the refrigerator costs a lot. And when I hear discussions of pricing, it seems to me we're still trying to price it as if we're pricing ice, whereas, in fact, we're renting a refrigerator. So if you think of it as renting a refrigerator, that's the analogy we want, as opposed to we're buying ice.

So one third boreholes, one third system, one third customer and system and conversion. I thought I'd corrected that.

How do we solve the problem? Because this is now 2x. We need to get monthly costs to the homeowner near current electrical and gas bill. That's what we have to do. 2x, how do we get there? Well, we've got to reduce the capital costs. So you've got to work like crazy. The unions have to work like crazy. We have to get down the learning curve. We really have to do this, right? The capital cost must come down.

We have to allocate-- at the moment, we're overbuilding these systems. Loop one, 425 tons against 275 tons actually used. You overbuild the system-- or whatever the number are-- overbuild the system by a massive amount. Somehow or another, the excess capacity has to get banked, and the customers only have to get charged for the actual used capacity.

Third, this is a lot of the discussion. How do we monetize some of these other benefits? How do we get a heat-pump tax? How do we get an investment tax credit? How do we get some payment for the avoided utility investments? Those are huge.

Monetize other benefits and apply. And then the financial-engineering part is, how do we spread the recovery of the capital over 30 years in constant terms, inflation-adjusted terms, real terms? If we run it through the current utility model, it looks like this in real terms. It's big in the first year. It gets smaller over time. It's twice as high as it ought to be because we're not even using a nominal-level payment mortgage. We're using rate of return plus depreciation, right?

Well, 30 years ago, we invented a level payment novel mortgage. How do we spread the cost of capital equally in real terms over time? If we could do all of those things, we'd be there. So you do your job in getting the cost down. Really build it neat. We find a way to bring in some of the other grants and tax incentives. We grab back some of the avoided costs out of the electrical system. Ideally, we'd get some carbon credits for the carbon saved, and then we'd spread the capital cost evenly. And then people say, gee, this is more economical than the existing system, and it's better for our kids. It's better for our community. We avoid the heat islands. We avoid all the other stuff. So we get all these other bennies for free, in a sense.

Learning curve-- so learning curve, right? There are learning curves out there. There's evidence out there. It looks like you've got 50% from one to two, but, probably, this is going to be an 11% or 12% learning curve over time. There's a lot of evidence on this. So to the rate-based folk, we'd say you've got to be willing to eat some of it because you're investing against the learning curve, and there's an investment in the learning curve. And so you can't load all of the current costs onto the current customers because part of the current cost is a public benefit of the learning curve that everyone else will gain. And so this has to be built into the thinking.

Excess capacity-- well, let's allocate only the capacity used, right? And the excess capacity is banked. Mechanisms to monetize benefit-- so assignment of carbon tax or renewable energy, linkage of various incentive systems, assignment of avoided cost credits. I mean complicated, really complicated and hard to do, but we've got to get our act together and make this all in one place.

Capital recovery model-- and I don't expect everybody to follow this at 3:30 in the afternoon. But if you take cost of capital times unamortized capital plus depreciation and you look at your annual charge, it starts on a 50-- it starts high, and it comes down over time. If you have a level nominal charge, it's like that. A level real charge would be rising over time with inflation.

Short story. If you had a payment that looked like an index Treasury and you could tell people that looks like Social Security because Social Security is indexed to inflation-- if you have a payment that's indexed to Social Security, it can start at 1/2 the level of a fixed nominal payment, and it will grow at Social Security over time, and it will give the utility the rate of return that they're allowed full recovery of capital. Yeah, it's fairly straightforward. You just have to do it.

So constant real capital recovery, there are ways to do this. I wrote it up in 1975 for totally different reasons. It's all in there.

OK, now, alternative pricing models. We could consumer purchase in-home and the utility supplies the common stuff or the utility supplies everything. Those would be the two choices. And you could charge for thermal usage, or you could charge for capacity. I personally like charging for capacity. I'm being told five minutes. I think thermal usage is a little bit like charging for ice in the ice box. I'd like capacities. These are fixed-cost systems. You're largely talking about recovering capital costs. But one, two, three, or four.

But now let's get simple. Path forward, stage one, pilot stage. Stage two, rollout stage. Stage three, steady state. In pilot stage, there are only very few systems. They're incomplete. There's no market. There's no thermal market. And the vintage for the technical types, the vintage of capital is too young. It's all new. And so if you have standard rate recovery, you're going to be recovering way too high rates.

What would I do if I were in Jamie's position? I'd say in the short run, we fix the cost equal to the current charge per unit of capacity, period. And we charge the customer with that amount, and the difference-- 80% of the difference we stick on rate base. 20% of the difference we give to Nikki so she has an incentive to bring the difference down. We say, basically, we're going to price it off current gas plus electricity, and we're going to stick the rest of it-- the rate base for learning curve, for learning, for all of these other benefits-- in the first-- and you might, to protect yourself, you might say for up to 3% of the installed base or up to 5% of the installed base. This is a learning investment. It just matches the old one.

Rollout stage, you're still going to have relatively few systems, but you can do a cost-of-capital recovery on those systems, as long as it's level and real, as opposed to nominal and declining.

Steady state, it doesn't matter because you're going to have investments of all vintages, and it's going to look like the existing system. And you could go back to the existing system if you wanted to, but by then, you would have devised a new system.

And remember, this is the problem for utilities in general. We're going from operating costs to capital costs. Renewables are capital costs. We're getting rid of fossil fuels, which are operating costs. So this helps us actually move from a volumetric to a capacity charging system.

OK, I've got two more minutes. Consideration for low-income, low-wealth households, I think this would be a great area. Take the one third that is the retrofit in the internal system. Get the Boston Foundation to work with you. Get them to buy down the cost of the household part for low-income households. Don't throw it at the utility. Say 2/3 of it is a standard rate, and if you qualify low income, we'll buy down the other third. And that will help us get all of the 20 houses around the cul-de-sac to convert. Then there are appendices. So that's it.

[APPLAUSE]

SPEAKER: So thank you, Don. So Don is a neighbor, and I went for a walk. And I said,

DON LESSARD: We are neighbors.

SPEAKER:

--well, here's where we are with the cost. Can you figure out some solutions? And if you didn't catch that in the deluge of information and ideas, he's putting out a whole bunch of series of solutions to deal with the cost as it is today with the first projects. And one of the things I want to flag on that is that that cost today with these first projects includes the entire cost of the building transition, which, incidentally, also includes all of the challenges of our aging-- I think someone said crappy buildings. Yeah, we have crappy buildings here. Just saying it.

And all of those problems that are from a hundred years of neglect-- the asbestos, the mold, the faulty wiring, the code violations-- they are a part of the challenge of decarbonizing our buildings because you cross the threshold, and you have to deal with them. And so that cost is baked into that total sum.

Part of what Nikki was referring to is going into new builds, you don't deal with that at all. And even today, those pipes and boreholes can actually balance out for the energy supply in a kind of more classic gas utility approach.

So the incredible news is that we might have tools to remove the cost of all of our building upgrades, which has all these other incredible benefits like health and well-being and comfort. So I just wanted to clarify that distinction.