Sam R. Christensen

SR 2816, Oral History, by Judy Hartman

Portland General Electric Centennial Oral History Series

1988 January 12

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JH: Judy Hartman
Transcribed by: Unknown; Melanie Mitsui, 2017
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Tape 1, Side 1

1988 January 12

JH: This is an interview with Sam Christensen, the general manager of generation and facilities engineering, with Judy Hartman on January 12, 1988.

First of all, I just need to have from you an overall view of what generation and facilities engineering is, because I know it is obviously very clean-cut to you, but for some of us on the other side of the company, it is really not.

CHRISTENSEN: Basically, we provide the engineering support and troubleshooting, and problem solving for all the generating plants, except for Trojan, and facilities, except for Trojan also. It has to be a little more complicated for facilities, so somebody can go out and solve the problem. Like we have emergency generators in this building here through [Inaudible] load dispatch. [Inaudible] to that type of – all the hydro plants.

For example, this is a listing of the jobs that we are working on right now for 1988.[1] Each element is a different problem at a hydro plant, or it's Beaver, or Boardman. We provide the engineering service and order large, long lead-time items or materials for these projects. Ones from paving a parking lot, to rebuilding, to the generator. [Inaudible] everything that way.

[1] Addendum 1, 1988 Job Sheet

JH: You are in to pave the parking lot? Hmm.

CHRISTENSEN: The only thing other engineering group besides the Trojan one is the one that does the substations and transmission lines under the 115 volt, and they also do distribution. Wayne Mays has that.

JH: That's under Walt Higgins? Before Trojan, am I to understand that the generation and facilities, all the engineers, were in one group? Sort of? Then Trojan came along, and all of a sudden we had nuclear?

CHRISTENSEN: Let's go back and I will tell you what happened. When I first came into the company, we had two engineering groups: one was substation engineering and one was, they called it structural engineering. Structural engineering had all the civil and mechanical engineering, and the substation had all the electrical engineering. We went along that way and provided the support for the hydro plants. Electrical was supplied by the substation group, and the civil mechanical support was supplied by the structural group, who went to a substation, we took the towers and foundations, [Inaudible], that was done by the structural group, and the electrical stuff, engineering, was done by the substation engineering group. Then Trojan came along, and what initially happened was that it was divided in the same way, the electrical portion of Trojan was kept in the substation, and the civil mechanical became the structural group in the organization. Then we started hiring engineers to support the design review efforts at Bechtel, who was doing the design. Initially we had a civil mechanical group. I was the chief of the civil mechanical for the company. We had probably six or seven people working on Trojan at that time.

As things grew, it got a little more complicated, and the interface with the electrical had to be much closer. They took the group that I had doing facilities, and transferred it to electrical, and transferred the electrical people that were doing Trojan over to me, and we then became generation engineering. We kept that going for quite a while. This generation engineering had Trojan, and the hydro, we had certain hydro portions, too. All of the civil

mechanical that we had, the electrical on the Deschutes River. It was a little complicated how we kept that up through Trojan. Then Pebble Springs came along and we maintained, we just kept growing. Then as Boardman came along, then we grew some more. Then it was decided it would be better to have nuclear engineering – strictly that's all they did. Before we had engineering at Boardman coal plant and engineering on Trojan. It worked out, because we could shift the people, whatever the emphasis was at a particular time, but it also made it so that engineers did not know that particular plant as well as they could have. So they decided to split a group and just call it Trojan. So they split that group off. At the same time when they did that, we moved the facilities back to the substation group, back down to generation engineering, became generation engineering group. I can give you time frames on that period, was about 1980, when we broke off Trojan, the facilities portion of it.

JH: So Trojan had been on-line for a number of years before you split. So it was working pretty well?

CHRISTENSEN: Yes, it was. We had Bechtel doing a lot of work for us at that time. We didn't have as many people as we have now, too. I think we had close to 80 or 90 people doing engineering at Boardman, doing the hydro plants, doing Trojan. Then we had about 30 or 40 people down at Bechtel. I don't know how many we have now, a couple hundred.

JH: You said that you had Bechtel working for you when you were doing Trojan. Did we have contractors like that when we were doing the hydro-electric projects on the Clackamas or was that pretty strictly P.G.E. operated?

CHRISTENSEN: The only ones I can tell you for sure about is North Fork, and Pelton, and [Inaudible].

JH: The other ones then were there a long time ago!

CHRISTENSEN: The youngest one is about 1922. Just before I was born. When I came to this company in 1956, they had just finished Timothy Meadows dam, they were working on Pelton, completing it. I think it was completed in 1957.

JH: I can find Pelton. It's pretty big.

CHRISTENSEN: Then North Fork was completed a short time after that. All three of those plants were done by EBASCO [Electric Bond and Share Company] as the A.E. [Architectural Engineer], and the design and review was sort of skimpy. They had a consulting group, outside people helping to review, but generally speaking it was pretty much left up to the A.E. how it was done. Round Butte was built next. It was done by Bechtel, and it had a fairly extensive design review committee made up of famous – oh, Dan [McClutsen?], geologist, things like that. It was built pretty much in 1964. What happened in each one of the cases, after the plant was declared operational and engineers took over and had to complete it [Inaudible].

What would happen, is we would come down, and it would take you about a year of getting – operating something and find out they need a new something. There were always things that were not quite the way they should be. At Round Butte, it took us a couple years to fix that. In fact, I think [Inaudible] six month or something [Inaudible], just to get the thing so it would operate satisfactorily. Bechtel did Round Butte. Then when we started looking for plant sites for Trojan, they hired Bechtel to look at where the plant could be located. Nuclear plants. That kind of criteria was somewhat less than it is today, [Inaudible]. We didn't have some of the restrictions you would have, even as late as when we started Pebble Springs. The plant sites we looked at for Trojan were all the way down at the Coast, very close to the Lewis and Clark expedition site. There was one site very close to that. I think Megler was the next one. [Beaver?] was one, and Trojan of course. There was one at Deer Island, and even an earlier study for a fossil coal plant was out here at Hayden Island. Trojan was chosen pretty much because of the foundations, they were

much better than any of the other sites. Somewhat we left out a little bit in that area, because some of the other sites were [Inaudible].

JH: I am just imagining a Trojan on Hayden Island. It is really hard to conceive how we would handle community perceptions. So close to the core. I am going to digress just a little bit to follow your thought. What do you see, looking back, as the major difference between siting Trojan and beginning the Trojan Nuclear Plant and doing Pebble Springs? We got one successfully to completion and online and we didn't get the other one.

CHRISTENSEN: I think I have to fault the company a little bit. When Trojan was started I went to a course in general accounting, down at University of Oregon. This course was a general thing, specific for a [Inaudible], but it was also closer to what you should be doing to get you community ready [Inaudible]. And this individual told me, anyway, and the class, he said, you better get out there and educate the people in the community, because if you don't what will happen is that somebody else will educate them in the other way. I came back and told Osborne. His view was to not do – we didn't get out there and do anything education-wise with regard to nuclear power – "Do your thing and take care of it just the way we have done it for years. Tell the politicians what you are doing; make sure you've got the mayors on your side. Go through that type of real P.R. [Public Relations] type [Inaudible] to political organization types. We went along that way and initially, of course, the newspapers were pretty much for us, because nuclear power was doing away with those dirty coal plants, and it was going to also do away with these dams, which would move the fish. Something that was clean power. So they went along.

There was quite a little opposition. You look, there was a few people who got up. I'll never forget some gal had worked up at Hanford and lived down in St. Helens, she came and said, "Hey, nuclear power, I would live there. [Inaudible] My husband worked over there, and my father worked at Hanford. They were clean. They never came home really dirty. I think it's the greatest thing." Everybody looked and said, "That's a nice gal." She really spoke. We had a lot of a grade of people that said nuclear power, it's more the

problem of being associated with the nuclear bomb. People didn't understand what the difference was between a nuclear bomb ban and [Inaudible]. Anyway, the waste and all that was not even thought of, or even transportation wasn't thought of. People just thought it was an emotional nuclear thing. But then we got it in. We had intervention mainly on the geological area, and somewhat on the fish. We converted some of the cooling systems to a cooling tower and [Inaudible], so the heat really wasn't a problem. There was some concern for chlorine, but that – [Inaudible] was produced. We finally made a settlement.

Then Pebble Springs came along, and the attitudes changed. The state was into it much more deeply. We were close. The plant was initially sited for Boardman, and I feel the state really [Inaudible]. What they did, they tried to use us as the [Inaudible] to get rid of the Navy out at the bombing, well, the weapons testing range over there, and it backfired. What happened, [Inaudible] that Tuck was trying to find some sites up in Washington for this bombing range and Scoop Jackson wouldn't give a stick about that. He wouldn't allow his constituents to get fouled up with something like that when it's already done. We never had a ghost of a chance to really move that thing. So it ended up we had to move it over to Pebble Springs. At that time, we were too late. The date [Inaudible]. They were going to do the best job in siting it. We were going to play a little N.R.C. [Nuclear Regulatory Commission] at that time.

JH: The regulations were really...

CHRISTENSEN: Then Marbet came along with some help, undoubtedly some of our lawyers at that time, appealed to come and stop [Inaudible] to the Supreme Court. I don't know what in the hell they were thinking of, but they let it be said, Yes. So then they had to go back and rewrite all the standards. What were they going to judge it on? In other words, they set up these standards, but they never understood what the criteria for the projection was, whether it was acceptable or not acceptable. So that took a long time, and of course, things were going on. The cost of these plants was rising up and up and up. In fact, Trojan started out, it was going to cost us $200 million, and finally ended up costing

$450 million. But Pebble Springs was to cost us something like a half a million, and when it was [Inaudible] I think it was $1.8 million, billion. The thing was, Trojan doubled the assets of the company, and Pebble Springs would have tripled it. You can't [Inaudible].

JH: What was the final, if there was any one thing you can pinpoint, the final bringing down of Pebble Springs? Was it just a long process of things that weren't working? Was there one final straw that somebody finally said we're not going to do this anymore?

CHRISTENSEN: The cost. We came to the realization that there was no end to this thing. You can't raise that amount of money and triple the capital [Inaudible] of the company. We weren't funded.

JH: I wasn't sorry to see it go, actually.

CHRISTENSEN: The idea – initially when we bought the nuclear steam supplies from B&W [Babcock & Wilcox] in order to generate [Inaudible], we bought it for a plant that would have been completed in 1979, knowing that we were going to work [Inaudible] until 1980. So this thing would have been on-line by the time the cost increases really had gone up. Except the State of Oregon not even allowing us to build in a certain place.

JH: I didn't realize it was that short a time frame.

CHRISTENSEN: [Inaudible]

JH: That was the way it was written.

CHRISTENSEN: That was the way we purchased everything. We knew we had to have everything included. All kinds of things. That was the way we purchased. [Inaudible] in May of 1974. [Reads from document] Notice of Intent filed on December 7, 1972. The Court of

Appeals rules that sites should not be returned to counsel. After being filed for sites one year later [Inaudible, rapidly skims and reads snippets]…

JH: So we filed intent in 1972, before Trojan was even completed?

CHRISTENSEN: Yes.

JH: Boy, I had my time line all wrong.

CHRISTENSEN: [Inaudible, still reading too quickly]. They started putting down a list of everything that was promised, everything they could think that we had to file for. Everybody added to it. They put it on a computer, and they'd pull it up every so often. What was different things that we had to do, and what commitments were being made. Like, out at Pebble Springs, we had to not only get a license for the plant, we also had to get the state's permission from the water bureau, water resources thing, for the dams, we had to get water rights. We had to get permission to put a pumping plant on the rivers. You had to get approval by the fish agency. Just a multitude of different levels of different things you had to do. It started out that we just kept plugging away at these things. I am sure there were foul-ups. But generally speaking, by putting it all on a computer and pulling it up every so often, people said, hey, this is something we should have done more, and somebody out there who deals with the state says, hey we've got to do that, or somebody comes in [Inaudible].

One of the things on Trojan I'll never forget. Some way we had to get an air contaminant [Inaudible], and we forgot Washington, and we rushed over to Vancouver to talk to people there, that's where the headquarters were for that [Inaudible]. Then we also, maybe a little bit before that, we went to Olympia and talked to the Washington Siting Council, even though it was in Oregon. We were continuously talking to groups all the time.

JH: Did you feel during that whole time that being P.G.E. hindered or helped the project? Was P.G.E. looked upon as somebody friendly to work for or were they looked upon as sort of an adversarial bureaucratic, big thing?

CHRISTENSEN: I think it was [Inaudible]. I think P.G.E. helped. There were people out there, no matter what P.G.E. did, it was wrong. I think, in general, P.G.E. had a very good rapport with the people. [Inaudible] nuclear power, [Inaudible] the price of electricity was not that great [Inaudible].

[End of Tape 1, Side 1]

Tape 1, Side 2

1988 January 12

CHRISTENSEN: We were going to build a lot of coal plants, we were going to build a lot of nuclear plants over in Eastern Oregon. [Inaudible] In regard to the state, the state has become so bureaucratic that it is very difficult to deal with. I think there is a new style of writing that the newspapers have, where everything is under a byline, where the byline is such that the person puts his personal opinion, and the only way he can do that to get some notoriety is to make it controversial. I think that's what [Inaudible]. I think P.G.E. itself [Inaudible]. What we have done is, we used to be very close to the bureaucrats, [Inaudible]. People we had out there, Chuck [Inaudible], [Kevin Caddy?], [Inaudible] managers all respected me. If something was needed, they got it. [Inaudible]. I don't see that today.

JH: Sort of a camaraderie style of management that's missing. A sort of edge there that didn't used to be there.

CHRISTENSEN: What we have now is people out there representing us who know a lot, but they are not the respected class. Conflict with too young of people. The organization structure, [Inaudible]. When Don Shattuck [Inaudible], he welcomed [Inaudible] an atmosphere [Inaudible] and kept that [Inaudible], and everybody respected him [Inaudible].

JH: So you have lost a trust factor over time of people building it up, and having somebody they've learned to trust and respect, and attain credibility, and that's going by the boards with other people. What do you remember was the best humor about those years between 1956 and now? What did you like the best about it?

CHRISTENSEN: At P.G.E.?

JH: Yes. What keeps you on here?

CHRISTENSEN: What keeps me around? Money.

JH: First response from everybody I've asked.

CHRISTENSEN: I must admit, I think building plants. [Inaudible] a challenge, getting it up and done on time. Fighting for it. It's too easy to let something slip, or let something go. In the end it may cost you millions of dollars, and it doesn't really come to something, [Inaudible]. Once you get it completed and operational and satisfactory, [Inaudible], that's the fun. Now, get down to where you can exude something and be able to operate in the future [Inaudible].

JH: Even with the completed development of Sullivan and the upgrading of some of the old dams, that's not as much fun as building them fresh?

CHRISTENSEN: No, it's not as much fun. Not sure that [Inaudible] once you get into them, can't believe they are still operating. Improve them to a point where they can operate for a number of years, [Inaudible] to create something new. [Inaudible] Oh, there has been some satisfaction. I don't think the way we are building some of these power plants, [Inaudible], make decisions that will affect operations and finance for 50 years.

JH: Are there any plans in the near future that you know of to have any of our hydro-electric projects go off?

CHRISTENSEN: Never build them?

JH: I don't know of any plans to build any, but are we considering not having any more, like Sullivan, the ones that are low, just having them die and not keep them up?

CHRISTENSEN: At one time, way back, I would say the late 1960s, we were looking at possibly Bull Run. The reason was that the maintenance cost of that plant was the highest hydro plant [Inaudible] per kilowatt-hour.

JH: Was that because of its location primarily?

CHRISTENSEN: No, the way it was built. The people who built it were promoters and they were just out to build something. They were really not as interested in that power plant – see, they ran a train, not a train, a trolley line from Portland, and then ran it up to Dodge Park.

JH: And the company owned the trolley line, so there was the reason.

CHRISTENSEN: And the track went on to Bull Run to the dam. The things they did, how they built it, they went to the top of the knoll there and they cut it off to the ground, taken down to some good foundation, [Inaudible].

JH: Sort of what a kid does in a stream?

CHRISTENSEN: Well, let me say this, I was looking at the design, I was a young engineer at this time. I came along, and it was losing so much water, I said, You don't have the factors you want. [Inaudible] What happened was, Bull Run used to have a [Inaudible]. They'd fill Lake Roslyn up in the daytime, or I mean at night, and [Inaudible]. That kept the seepage line where the water was coming in fairly low. Well you know, the City of Portland built another pipeline down from Bull Run to the city, and excess water [Inaudible], dump water into Roslyn Lake and kept the waterline way up. [Inaudible] made it so that a lot of water wouldn't pass. [Inaudible] So we lowered the lake, we came in and put a backup dike there.

JH: So if Sam Christensen as a young engineer hadn't come along, we would not own Bull Run for very much longer because it would have not been there from before.

CHRISTENSEN: Bull Run was just a, it has a five-mile – have you been up there?

JH: No. Well I have been by it, but I have never been into it.

CHRISTENSEN: [Inaudible]. There is a little train.

JH: Still?

CHRISTENSEN: Oh yeah. Definitely. That's how they do the maintenance stuff.

JH: I didn't know it was still operating. I have great pictures of the flume. Who do I call to get on the train?

CHRISTENSEN: There is a rail track up there. This thing runs from the top of [Inaudible]. You get to Little Sandy and the Little Sandy Dam, and that's the end of the thing. And then there's a tunnel there, and then you go around to the other side of the tunnel, and there is a concrete box flume [Inaudible]. It was quite a job to try to beef that up a little bit. Then there is a canal section, little tunnels underneath [Inaudible], then you go up and there's another canal section, and we come to a quicksand dam, Marmot Dam, our facility there. There's a fish screen [Inaudible]. Then, Marmot Dam is sort of deteriorating to a point that we are not sure it is saving [Inaudible]. It was built in 1913, in one winter. That whole system is just a maintenance nightmare. Because everything there was not built for – like I said, it was mostly promotion people that built it, then started a generating facility.

JH: Are we keeping it because we consider it an asset, or because we don't seem to be able to get rid of it?

CHRISTENSEN: Oh no. Now with the price of power gone up, it's making money for us. See back then, we were selling power for around 2 cents, or a cent and a half, and it cost 2 cents to generate out of Bull Run, because of high maintenance [Inaudible]. Now that we are selling it for 4 or 5 cents, and it only costs 2 cents to generate, not too bad.

JH: We are sort of skipping around here. What would you like to see in this history book? What would you like to have recorded for people who might be reading this in years to come? Make sure we haven't left out anything.

CHRISTENSEN: I would like to see, we got somewhat into it, is maybe be able to generate a feeling of philosophy of the company during different periods. We have gone through tremendous transitions, periods of austerity, to hiring [Inaudible] to get the job done. Maybe this will happen. [Inaudible] go back 10 years later: What was the philosophy? [Inaudible] – we just didn't have enough people with knowledge of people, ingenuity [Inaudible] to get the job done. There has always been money to get a plant built, substations going, transmission lines, [Inaudible]. Part of that in the 1950s, there was steady growth, from a lower base, so we were just thinking of hydro, there was only maybe 300 megawatts [Inaudible]; in the 1970s you're talking 500 megawatts, 1,000 megawatts, [Inaudible] Where are we going to get the power? [Inaudible] Maybe it was just a philosophy of what…

JH: What do you think caused the bubble to burst? What do you think was the big change between the 1970s and the 1980s? Because in the 1950s, the electric utility industry as a whole was fat and happy with Gold Medallion Homes going up all over the place. Electricity was in state fairs and world fairs and trade centers all over. In the 1960s, we were getting bigger and building big construction projects, even in the 1970s. And then, in 1972 we started getting energy conscious and we had the oil fear.

CHRISTENSEN: [Inaudible]. Everybody kept saying the price of electricity was going to last. It didn't matter what we charged. [Inaudible], and we kept believing it and we kept building. Then we found out that's not true. There were alternatives. One was through conservation, was a way of reducing it, and that I think – our whole foreign buying and selling cars, foreign cars were coming in at that time [Inaudible]. We weren't shipping them. Our cars weren't [Inaudible] cars and T.V. sets. The economy was slowed down by the fact that [Inaudible]. Like the stock market.

JH: I was going to say, a good analogy to the stock market. You think it's is going to go up and up, and then something happens in your life and it doesn't go that way.

CHRISTENSEN: We're finally starting to look a little bit [Inaudible]

JH: What size of a job is that?

CHRISTENSEN: Oh, a million dollars, [Inaudible]

JH: Do you think from where you sit that P.G.E. is pretty well positioned for going into the 1990s, or do you think we have some more learning to do? We have survived a hundred years if we can make it to January.

CHRISTENSEN: I think we have got a lot of – we've got to relearn. We have a lot of new people. It will take a while. I think we can survive. But we are losing a lot of people. [Inaudible]. People who are leaving are [Inaudible]

JH: That's one of the sad things that I found out in my speaking with a lot of people is that there doesn't – we haven't been able to come to the realization that the old school can teach the new school and the new school can teach the old school. There isn't a

sharing of the best from both worlds yet, and I think we are not going to make it unless we get there.

CHRISTENSEN: I think we are going to make a lot more mistakes.

JH: I think we will make it, but it will be harder. It will be a lot more chaotic and hard on a lot of people. Doesn't necessarily need to be so.

CHRISTENSEN: There is going to be some hard-knock learning new technology. I can see there are a few people, they can do it on their own. They are being told to do things. You can make it on your own, don't go back [Inaudible]. I still think that's a loss, a misguided philosophy.

JH: Hopefully, the history book will change some of that. I have learned a lot about what this company went through to survive. A lot of it is well-learned and should be known by new people who are coming in so that they don't make the same mistakes twice or at least they do it with a little bit of knowledge that somebody has already done this before. Maybe they don't want to do it again; it was real painful the first time, thank you.

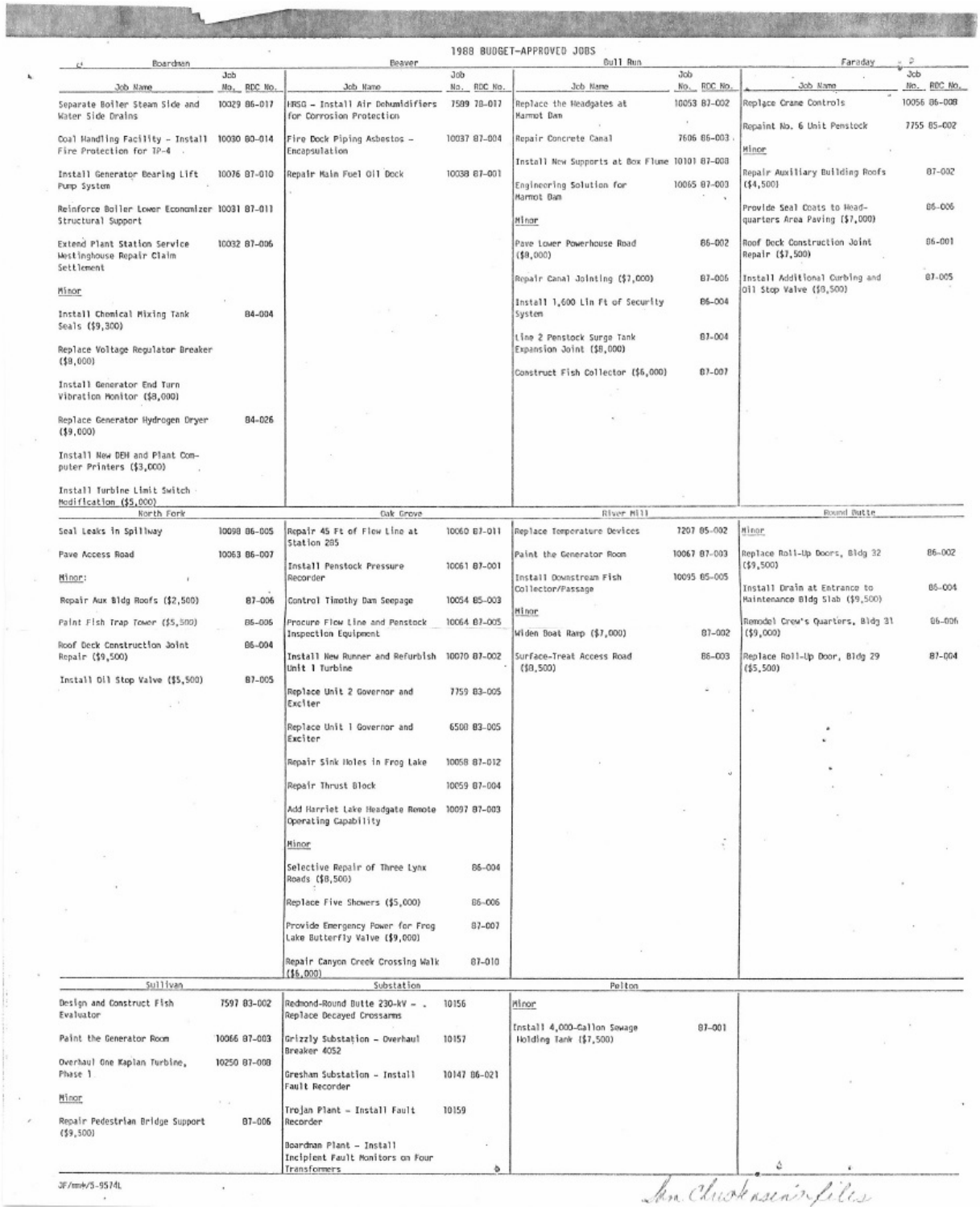
CHRISTENSEN: I was somewhat surprised at the way they transitioned, the way they did the divisions. I think consciously it was the realization they did not want [Inaudible].

JH: Very abrupt, very sudden. Well, thank you, Sam, you have been just great. May I ask you if I can have a copy of this and a copy of your Pebble Spring licensing chart?

[End of Tape 1, Side 2]
[End of Interview]

Addendum 1

1988 Job Sheet



1988 BUDGET-APPROVED JOBS

Boardman

Job Name	Job No.	RDC No.
Separate Boiler Steam Side and Water Side Drains	10029	86-017
Coal Handling Facility - Install Fire Protection for TP-4	10030	80-014
Install Generator Bearing Lift Pump System	10076	87-010
Reinforce Boiler Lower Economizer Structural Support	10031	87-011
Extend Plant Station Service Westinghouse Repair Claim Settlement	10032	87-006
Minor		
Install Chemical Mixing Tank Seals ($9,300)		84-004
Replace Voltage Regulator Breaker ($8,000)		
Install Generator End Turn Vibration Monitor ($8,000)		
Replace Generator Hydrogen Dryer ($9,000)		84-026
Install New DEH and Plant Computer Printers ($3,000)		
Install Turbine Limit Switch Modification ($5,000)		

Beaver

Job Name	Job No.	RDC No.
HRSG - Install Air Dehumidifiers for Corrosion Protection	7589	78-017
Fire Dock Piping Asbestos - Encapsulation	10037	87-004
Repair Main Fuel Oil Dock	10038	87-001

Bull Run

Job Name	Job No.	RDC No.
Replace the Headgates at Marmot Dam	10053	87-002
Repair Concrete Canal	7606	86-003
Install New Supports at Box Flume	10101	87-008
Engineering Solution for Marmot Dam	10065	87-003
Minor		
Pave Lower Powerhouse Road ($8,000)		86-002
Repair Canal Jointing ($7,000)		87-005
Install 1,600 Lin Ft of Security System		86-004
Line 2 Penstock Surge Tank Expansion Joint ($8,000)		87-004
Construct Fish Collector ($6,000)		87-007

Faraday

Job Name	Job No.	RDC No.
Replace Crane Controls	10056	86-008
Repaint No. 6 Unit Penstock	7755	85-002
Minor		
Repair Auxiliary Building Roofs ($4,500)		87-002
Provide Seal Coats to Headquarters Area Paving ($7,000)		86-006
Roof Deck Construction Joint Repair ($7,500)		86-001
Install Additional Curbing and Oil Stop Valve ($8,500)		87-005

North Fork

Job Name	Job No.	RDC No.
Seal Leaks in Spillway	10098	86-005
Pave Access Road	10063	86-007
Minor:		
Repair Aux Bldg Roofs ($2,500)		87-006
Paint Fish Trap Tower ($5,500)		86-005
Roof Deck Construction Joint Repair ($9,500)		86-004
Install Oil Stop Valve ($5,500)		87-005

Oak Grove

Job Name	Job No.	RDC No.
Repair 45 Ft of Flow Line at Station 285	10060	87-011
Install Penstock Pressure Recorder	10061	87-001
Control Timothy Dam Seepage	10054	85-003
Procure Flow Line and Penstock Inspection Equipment	10064	87-005
Install New Runner and Refurbish Unit 1 Turbine	10070	87-002
Replace Unit 2 Governor and Exciter	7759	83-005
Replace Unit 1 Governor and Exciter	6508	83-005
Repair Sink Holes in Frog Lake	10058	87-012
Repair Thrust Block	10059	87-004
Add Harriet Lake Headgate Remote Operating Capability	10097	87-003
Minor		
Selective Repair of Three Lynx Roads ($8,500)		86-004
Replace Five Showers ($5,000)		86-006
Provide Emergency Power for Frog Lake Butterfly Valve ($9,000)		87-007
Repair Canyon Creek Crossing Walk ($6,000)		87-010

River Mill

Job Name	Job No.	RDC No.
Replace Temperature Devices	7207	85-002
Paint the Generator Room	10067	87-003
Install Downstream Fish Collector/Passage	10095	85-005
Minor		
Widen Boat Ramp ($7,000)		87-002
Surface-Treat Access Road ($8,500)		86-003

Round Butte

Job Name	Job No.	RDC No.
Minor		
Replace Roll-Up Doors, Bldg 32 ($9,500)		86-002
Install Drain at Entrance to Maintenance Bldg Slab ($9,500)		86-004
Remodel Crew's Quarters, Bldg 31 ($9,000)		86-006
Replace Roll-Up Door, Bldg 29 ($5,500)		87-004

Sullivan

Job Name	Job No.	RDC No.
Design and Construct Fish Evaluator	7597	83-002
Paint the Generator Room	10066	87-003
Overhaul One Kaplan Turbine, Phase 1	10250	87-008
Minor		
Repair Pedestrian Bridge Support ($9,500)		87-006

Substation

Job Name	Job No.	RDC No.
Redmond-Round Butte 230-kV - Replace Decayed Crossarms	10156	
Grizzly Substation - Overhaul Breaker 4052	10157	
Gresham Substation - Install Fault Recorder	10147	86-021
Trojan Plant - Install Fault Recorder	10159	
Boardman Plant - Install Incipient Fault Monitors on Four Transformers		

Pelton

Job Name	Job No.	RDC No.
Minor		
Install 4,000-Gallon Sewage Holding Tank ($7,500)		87-001

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Ann Chuckmans files

Addendum 2

Timeline

Dimming Our Electric Future

By John Siegel and John Sillin

Demand for electricity will grow 4% to 5% a year through this decade—nearly double current industry projections. The implications for our power supply are significant, with new plant and equipment commitments of at least $1.5 trillion required over the next 10 years.

This presents a paradox. While nuclear and coal plants are scrapped and the "green coalition" works to erect disincentives to central-station technology, we soon may be in dire need of more electricity, with no coherent strategy on how to get it. One thing is clear: Utilities don't buy this projection. Having been so badly burned financially in the past 10 years, they are no longer willing to "bet the company."

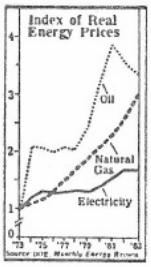
The real question for the future is what electricity policy we will be dependent on: cost-effective coal or nuclear technology, shorter lead time but higher operating cost combustion turbines, or price-induced conservation partly resulting from inadequate electricity supplies around 1990? Politicians and regulators hold the answers.

Increased electricity growth in the 1980s will occur for two reasons: improved economic growth above the 2.2% average of the past 10 years and market forces associated with electricity's dramatically improved price position relative to oil and natural gas.

The economy is in a fundamental transition, just as in 1973. This time, the transition is toward sustained economic growth in the 3.5% range, enhanced by coherent, long-range economic policies, stable or falling energy prices, and more moderate growth in the labor force. In short, a mirror image of the 1970s.

Nonlinear Relationship

Economic growth in the 3.5% range should work to strengthen the relationship between electricity demand and economic growth. Historically, this relationship has been nonlinear, trending upward during periods of sustained economic growth. Between 1960 and 1972, when annual gross national product growth averaged 4%, electricity growth was double that of GNP. Between 1973 and 1982, when GNP growth averaged 2.2%, electricity growth averaged 2.5%, or about 1.1 times GNP growth.



Reasons for the nonlinear relationship are clear. In periods of sustained economic growth, investment rates in new plant and equipment accelerate, resulting in a substitution of capital for labor, and increased energy usage. Further, in an improved economy, rising real income results in higher energy usage due to income elasticity effects.

From 1960 to 1972, for example, real personal income grew by more than 30%. Each percentage point rise in real income is estimated to result in a similar increase in electricity use; increasing real income contributed significantly to growth in electricity demand in the period. From 1973 to 1983, however, real income increased only 5%. In that period, the annual increase in capital spending averaged 1.1%, compared with an annual rate of 4.4% from 1960 to 1972. Further, a labor market expanding at nearly triple the 1960 to 1972 rate resulted in a substantial substitution of labor for capital—and thus less growth in energy usage. In the 1980s, more favorable financial markets, incentives to invest and a labor force growing at one-third the rate of the past 10 years should accelerate capital investment, productivity and real income growth—and electricity usage.

Electricity's greatly improved price position compared with oil and natural gas, and the likelihood that this will continue, is the second major reason electricity demand will top estimates.

Since 1973, electricity has improved its price position vis-a-vis oil and gas 150% (see chart). The resultant 22% gain in electricity use and 18% drop in gas and oil use enabled electricity to lift its domestic energy market share to 37% from 27%.

A possible shortage of electricity supply is closer than most imagine. With growth rates of 4% to 5%, demand will start to exhaust available supplies between 1988 and 1990. The implications are staggering.

Before 1973, electricity's penetration rate in the new home heating market was 30% nationally. Following the 1973 run-up in oil prices, it jumped to 50%. Recently the rate hit nearly 70%.

And what about conservation, integral to soft energy's "least cost" energy strategy? Conservation has clearly taken place as a result of the overall run-up in energy prices. But relative price changes of the various energy forms have caused electricity consumption to increase, despite past stagnant economic conditions. Further, to a market economist, conservation is defined simply as a price-induced process whereby capital and labor are substituted for energy. If electricity prices are not rising, is conservation a viable strategy?

In fact, there will be downward pressure on electricity prices. The prospect of stable fuel prices, the fact that 80% of our electricity (compared with 65% in 1973) is now generated using coal, uranium and hydro (all relatively price stable in the 1970s), and a decrease in unit production costs as utility reserve margins decline will more than offset the upward pressure from relatively higher-cost plants entering service in the 1980s. Real electricity prices could decline as much as 15% late in the decade. In turn, this could accelerate demand and lower unit costs even further. Along this line, real electricity prices fell 2% in 1983.

In combination, sustained economic growth in the 3.5% range and the market impact of electricity's improved price position suggest that 4% to 5% electricity growth rates for the 1980s are likely. This growth began in 1983:

- Weather-corrected peak demand increased 4% in 1983. (Uncorrected for weather, peak load rose 7.6%.)
- Over the latest 52-week period, total electricity sales increased 7% from a year earlier.

So much for arguing that electric growth is distinct from GNP growth.

A possible shortage of electricity supply is closer than most imagine. With growth rates of 4% to 5%, demand will start to exhaust supplies between 1988 and 1990. The implications are staggering. Assuming a 10-year lead time for licensing and construction, no plant retirements, a 20% reserve margin, new plant commitments of 450 million to 700 million kilowatts—equaling investment of $1.5 trillion to $2 trillion—are necessary over the next 10 years. This compares with an effective ordering rate of zero for the past 10 years.

The immediate question is whether the electricity industry will continue to defer commitments to conventional technologies until reliability becomes an issue and the main recourse is to depend significantly on equipment with a short lead time but high operating costs. In that case, increasing electricity prices beginning around 1990 and questions of reliability could begin to limit electricity growth and hinder economic development, as well as increase oil and natural-gas consumption. Low growth projections could become self-fulfilling prophecies.

To avoid this scenario, the current institutional environment—characterized by regulatory/political actions biased against adding new generating capacity—must undergo sharp change. Given the relative price stability of electricity over the past 10 years and the prognosis for more of the same, regulators should encourage the addition of new capacity to coincide with realistic estimates of growth. One must keep in mind that, typically, it takes a decade to plan, design, license and construct a single large electricity generating plant. Given this lead time, the 1990s—for utilities and rate regulators—are *today*.

Gambling With the Public Interest

But little is being done. For example, New Hampshire and Indiana have laws preventing the inclusion of Construction Work in Progress in the rate base—the one sound mechanism by which utilities can finance large new plants. Connecticut may soon follow. The result? New Hampshire and Indiana have two near-bankrupt utilities on their hands and billions in potentially wasted investment. But the states have no monopoly on myopia. After the Federal Energy Regulatory Commission ruled that utilities could earn a cash return on CWIP, the House passed a bill designed to overturn this decision. Senate action is due this month.

Politicians and regulators are gambling with the public interest: trading off short-term political expediency against a longer-term reliable and cost-effective supply of electricity. The stakes are high, as analyses show that the cost to consumers of having an insufficient supply of electricity greatly outweighs the cost of having too large a reserve margin. With excess capacity, both consumer and stockholder share the burden. With a shortage, only the consumer pays.

Next year—following three years of electricity growth in the 4% to 5% range—public-policy makers may finally recognize that a reliable and cost-effective supply of electricity is in jeopardy in the late 1980s, and that conservation doesn't work when electricity prices are falling. We hope that regulators would then encourage utilities to add reliable and cost-effective generating capacity. The ball is in their court.

Mr. Siegel is a manager with the Atomic Industrial Forum. Mr. Sillin is a consultant with Alexander Grant & Co. The views expressed are solely their own.