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# DOUGLAS BRUCE STEWART

Douglas Bruce Stewart graduated with B.Sc. and M.Sc. degrees in Mining Engineering from Queen's University in Kingston, Ontario. He joined the Mines Branch of Energy, Mines and Resources (now CANMET which is part of Natural Resources Canada) in 1973 and worked on diesel emissions research as a research engineer and research scientist. In 1978, he moved to Whitehorse, Yukon as regional mining engineer and chief inspector of mines. In 1981, he returned to CANMET to establish the Cape Breton Coal Research Laboratory in Sydney Nova Scotia. In 1985, he transferred to the CANMET Western Research Centre at Devon, Alberta where he held a number of managerial positions before being appointed Director in 1995. In 2004, Stewart retired.

Date and place of birth (if available): July 3<sup>rd</sup>, 1949 at Portage la Prairie, Manitoba

Date and place of interview: July 25, 2013, CanmetENERGY Western Research Centre, Devon

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Full names (spelled out) of all others present: N/A

Consent form signed: Yes

Transcript reviewed by subject: Yes

Interview Duration: 2 hours and 18 minutes

Initials of Interviewer: AD

Last name of subject: STEWART



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AD: My name is Adriana Davies and I'm a Researcher/Interviewer on the Petroleum History Society Oil Sands Oral History Project. It is now 9:30 and it is the 25<sup>th</sup> of July 2013. I'm in the Canmet Western Research Centre facility in Devon and I'm interviewing Bruce Stewart, the immediately former Direct of Canmet Western Research Centre. Bruce, thank you so much for agreeing to be interviewed for the project.

STEWART: No problem, happy to do it.

AD: Good. Now I know that you have some fascinating stories to tell us. Could you start by you telling me your birthdate and place where you were born, and then provide me with a summary biography, broad strokes, and we'll get into the details later.

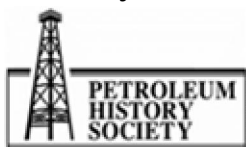
STEWART: Okay. I was born in Portage la Prairie, Manitoba on the 3<sup>rd</sup> of July 1949. I am the eldest child of a prairie farm couple who never did farm. My father went off to World War II and flew Dakotas in the Husky Squadron, and after the war he met my mother at university. They were married in 1947, I believe. They are now both deceased and I am the eldest of four children. My Dad was a career military officer so we lived in Canada, different parts of Canada, dominantly Ontario, and then later in his career dominantly in Ottawa, but every second posting was away from Ottawa; so, Washington, DC twice and Fontainebleau, France.

So part of my high school education was in Europe and part of it was in Canada. I went to Queen's University and did a master's in -- my undergraduate degree and a master's degree, both in Mining Engineering, and as part of my master's thesis I went to work in Ottawa in the Canadian Explosive Atmospheres Laboratory. I went back to that laboratory after I completed my master's and became a research engineer and a research scientist working on diesel emissions and the certification of flameproof diesel equipment. That was from 1973 to 1978.

I then went to the Yukon where I became the Chief Inspector of Mines and the Regional Mining Engineer; stayed there for three years during which time the price of gold went through its first big spike and everybody thought they'd become a blaster miner; that was interesting. [I] rejoined the federal government -- Energy, Mines and Resources Department in 1981 to establish the Cape Breton Coal Research Laboratory in Sydney, Nova Scotia.

I'd always had a lot of interest in research, a lot of interest in managing research, and the opportunity to create a research lab from scratch is something that doesn't happen very often to people in research. Usually you get to fix other people's issues and problems, so the opportunity to make your own initial steps at creating a facility was something I thought I had to do. Was there from 1981 to 1985; moved west to Devon in 1985, had a number of managerial responsibilities here in the research centre; took over as director in 1995 -- sorry, did I say '85 or '95? I may have misled you. I came west in 1985, had a number of managerial positions here and in 1995 took over as director. I retired from that position and retired from working in 2004. We still live in the Devon area and we split our time between summers here and winters in Arizona.

AD: Very succinct. Now, I'll backtrack. Why mining engineering? What intrigued you and ...



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STEWART: I actually had an uncle who was a mining engineer who worked for Hudson Bay Mining and Smelting in Flin Flon, and we had visited the Flin Flon area a couple of times and I just thought it was an interesting line of work. So I started out believing that I would live in small towns in isolated parts of Canada as a mining engineer working in the mining industry. Life didn't turn out quite that way. When I got into university and into grad school I realized that I was more interested in being part of a research organization than in being part of a production mining operation. So that's the way I went.

AD: So then, you know, just give me some, tell me some stories about your early career and, you know, what led you towards the work ultimately in Devon and the oil sands area.

STEWART: It's a very long and convoluted pathway. I went to work as a research scientist in Ottawa. Before I get any further down that path though, I better tell you a little bit about names of the organizations because they changed over time and it's a little confusing unless you really understand and if I jump into acronyms, please stop me and tell me to use real English words. The organization that I joined was known as the Mines Branch. It was created in the early 1900s and in some of the early documents it's referred to as the Federal Department of Mines, but dominantly it was called the Mines Branch until 1975, and then the name was changed to the Canada Centre for Mineral and Energy Technology. The organization, since its inception in the early 1900s, had always dealt with the science and technologies of minerals, metals and fuels and in particular how Canada could exploit its endowment in resources, and use minerals and metals and fuels as part of its industrial expansion. So, I will call it the Mines Branch occasionally, but I dominantly refer to it as Canmet.

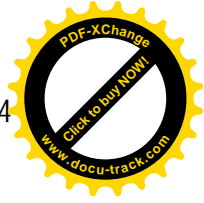
Canmet is now two parts: Canmet Energy and Canmet Minerals and Metals. The facility here at Devon is part of Canmet Energy. It used to be called the Department of Energy, Mines and Resources, now it is called Natural Resources Canada and I may refer to it as NRCan, which is Natural Resources Canada, or EMR, which is Energy, Mines and Resources.

So I started to work in Ottawa in the early seventies in the Canadian Explosive Atmospheres Lab. After five years, I decided that I really needed a little more industrial experience or an industrial kind of experience than I was getting there. An opportunity came along to apply for a job in the Yukon with the Department of Indian Affairs and Northern Development. So I went there; worked in Whitehorse for three years; was the Chief Inspector of Mines for the vast majority of that time, but also was the Acting Assistant Director for a while for the Department of Indian Affairs and Northern Development's activities in Whitehorse, and that was the Assistant Director of the Non-Renewable part, so it wasn't involved in forestry or water or those things; it was minerals; it was energy sources like coal and oil and gas.

In 1979, I believe, or maybe '78, there was a coal mine explosion in number 12 colliery in Cape Breton. As a result of that incident, the decision was made to establish the Cape Breton Coal Research Laboratory and I was asked to come back and join the department and undertake the creation of that lab. And I did that; moved to Cape Breton in 1981. So that was a coal research



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facility. It was a small facility, about 20 people. We had a program on strata-mechanics, which is really soft-rock geo-mechanics; how the rocks behave around openings underground and how the seam and the underlying materials interact with the fact that you've created a void that wasn't there before. We had a ventilation group; we had some dust research activity; and we had a small contract program where we actually financed other people to do contract research of interest to the coal mining industry. I stayed there for four years and then I moved out here ...

And am I rambling too far or is this kind of what you're after?

AD: No, this is exactly ...

STEWART: Okay.

AD: ... what I'm after.

STEWART: Came out here to join the Coal Research Centre here at Devon. When I went to Cape Breton I was part of mining research laboratories, but in January of 1982 the Canmet organization decided to create the coal research laboratories. I'm going to back up a little bit and talk about some of the background that led to that. Remember the oil price shocks in the 1970s? Remember the Club of Rome discussion about how we were going to imminently run out of easily extractable conventional sources of energy and we were going to have to do much better at looking at alternatives, and so there was a lot of interest in all forms of alternatives, and coal was one of them. So there was the Cape Breton Coal Research Laboratory that was being established; there was the facility that was being planned here and it was deemed to be important to create a coal research laboratory entity to supervise those projects. David Brown was the first director, appointed, I believe, in January 1<sup>st</sup> of 1982 and I believe you're going to interview him so I'll let him talk about that part of it.

But this facility was intended to be a world-class coal research centre that would look at ways to use -- well, sorry -- to produce coal and coal-derived fuels in ways that were more environmentally acceptable than the classical technologies at the time. So for example, there was large coal preparation pilot plant equipment here so that you could actually take a run of mine coal samples, put them through coal preparation techniques to remove waste rock materials, sulphur minerals and anything else that would contribute to it not being as good a fuel source.

There also was a large facility called the High Head Lab here, which was intended for high pressure and high temperature coal experiments intended to produce coal-derived fuels, liquids and gases. And if you think about it, you go back to the World War II activities, in Germany in particular, where they were looking at coal liquefaction. So coal liquefaction and coal gasification were on the agenda for this building.

So I came out here in 1985; the building opened in 1985 although researchers had moved in in the fall of 1984. Hassan Hamza was working here at the time and you're going to speak to him later today, I believe. Talk to him about that because he was the on-site guy who was here when the



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building was actually constructed. David Brown was coming back and forth from Ottawa for a while but Hassan was actually here in Edmonton prior to the construction of this facility.

The facility is interesting because it also was funded by a research fund that came out of the National Energy Program, and I'll let David Brown talk to you more about that because I think he was closer to it than I was. But it was the ability of the ... Alberta Canada Energy Research Resources Fund, which had a lot of money, which was the way to flow back, I guess, foregone royalties through the National Energy Program to the province that allowed this building to be created. It quickly became evident that the coal industry wasn't quite ready to support this kind of a facility, at least in a financial way.

Remember, as well, in the late 1980s, oil prices dropped significantly and there started to be some serious questions being asked about whether these clever Rome guys really knew what they were talking about. Were we really looking imminently at peak oil or not? Was it really going to be the end of relatively inexpensive fossil fuels? So it quickly became evident that this facility was not going to be sustainable in the long term as a coal research centre. That led us to look around at ways that we could better use the capabilities and the expertise of this facility and oil sands was an obvious target. A lot of the activities in coal preparation in particular dealt with fine particles and fine particles in water systems, and so an understanding of interfacial and surface sciences was important in coal preparation and equally important in understanding how to get bitumen out of surface mined oil sands through a bitumen extraction process.

Western Canadian coals also have a lot of clays in them, and fine clays, and there's a lot of clay in oil sands as well, and there are problematic issues associated with clays and water, and so that was another obvious connection.

So the decision was made here in the early 1990s to migrate this facility into oil sands. Now, at the same time, in the federal government there was -- and in fact in all levels of government -- there was a drive to try to connect institutional or public-sector research activities with end-users. So there was a lot more effort in terms of establishing linkages with the private sector at other research providers and in looking at ways that part, at least, of the cost of the research would be borne by the end-user, the assumption being if the end-user was involved, the end user could help steer activities in more appropriate and commercializable ways. So that was part of the driver as well. The coal industry was frankly not interested in the scale it would need to be done. So the oil sands became the target, became the target of this facility.

At the same time the federal government went through a serious reduction in all activities called "program review." Program review hit this facility fairly hard but it gave us another opportunity and that was the opportunity to relocate the upgrading research program, which was located in Canmet Energy in Ottawa, and moved that facility here to Devon. As part of that movement, it also led to the final commissioning of that entire high-head laboratory which had been intended to be a coal liquefaction and gasification facility, and had never really been used for much in the facility up until the oil sands upgrading people arrived. A lot of the details surrounding how that was done can be



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addressed by a guy named Bill Dawson who lives in Calgary and I believe your Calgary contacts have been in touch with him or will be shortly. So that's kind of how we got oil sands.

AD: Now, it would appear that as with many things and with government agencies, the hope ... the political sphere sometimes determines what happens to them, and you referred to the creation of this facility as the result of National Energy Program funding and also the desire of the federal government to have an interest in the oil sands but also in the province in which the oil sands were an economic driver. Now, I know that you are a historian of not only the Energy, Mines and Minerals Branch, but also you're interested in the federal government's involvement in the oil sands. Would you like to set the context because, of course, it wasn't just the 1980s and early nineties that the federal government became interested in the oil sands, or tar sands as they were once known, it was much earlier and I know that you have an interest and a passion for that. Do you want to go back and ....

STEWART: Okay.

AD: ... and tell me about the ... those early federal government research interests in oil sands?

STEWART: Okay, let me get you to why the federal government got interested in mines, minerals and fuels to start with now. When Canada became a country, it was basically an agricultural country. The majority of Canadians were farmers. In the late 1800s industrialization became more common, became more significant, and the question really was where is Canada going to find the resources and the technologies to develop and use and prosper in minerals, metals and fuels. There had been a lot of work done by the Geological Survey [of Canada] in trying to understand Canada's natural resource endowment. You had other line departments of the federal government working in areas like agriculture, and so we became an obvious area for the federal government to get interested in to make sure that the sciences and technologies that were needed were available to help Canada's industrialization occur. So that was really the driver behind the creation of the entity that I call the Mines Branch or Canmet.

At that time, there weren't an awful lot of other research players. There were research programs in universities and there's a book, in fact, that is relevant to this discussion because it summarizes the first 75 years of the Mines Branch experience. It's written by a man named Alex Ignatieff [A. Ignatieff, *A Canadian Research Heritage: 75 years of federal government research in minerals, metals and fuels*. Supplies and Services Canada, Ottawa, 1981]; was published in 1981. I don't remember its title. I do have a copy, which I've made available to this program and I believe it will be placed in the Glenbow ...

AD: Archives.

STEWART: ... archives at the conclusion of the project. It summarizes activities within the Mines Branch from its inception to, I believe, 1975. The first real oil sands activity was started by a man named Sydney Eills. He joined in 1913 and continued to work on oil sands until his retirement -- I believe retirement in 1945. A number of activities were undertaken. We had the Alberta Research



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Council Program that started in the 1920s and there was a lot of interest in the 1930s and forties in oil sands, including high pressure, high temperature bitumen conversion activities that were done in Ottawa by the Mines Branch.

There's also the first reference that I've seen to the potential problems associated with oil sands tailings from the water extraction process in work that was done at lab scale, I believe, in the late 1940s.

AD: Now, that's interesting because of course then this becomes a major issue ...

STEWART: Many years later.

AD: ... throughout the industry.

STEWART: Yeah.

AD: Do you know where one might find that source, that report; any ideas?

STEWART: Yeah, the only source I've seen of it would be in Alex Ignatieff's book ...

AD: In the Ignatieff book.

STEWART: ... but there has always been a Canmet library and they have always tried to keep a pretty good set of records, and you may actually be able to get a hold of them and find a pathway to at least seeing parts of that report.

AD: Because, you know, in terms of the research that I've done on the various facilities, both the government-run ones and the one commercial venture, it was, you know, all guns blazing and don't worry about the environmental impact. I mean when you see the photographs and they're in the Ignatieff book of ... the various sites like Bitumount. I mean ...

STEWART: Okay.

AD:...you know, they're ...

STEWART: Yeah.

AD: ... in today's terms everything is coated in oil, I mean it, and everything, you know, barrels, pits, everything are left in a state of disrepair so there's no sense of the implications. But the notion that the federal government was aware of a tailings issue was early as -- I guess it would've been mid- to late-40s, right?

STEWART: I believe that's when this particular work was done. What they identified was the fact that at lab-scale work that they had done, little bench-scale units, that the clay fraction and the water



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fraction became a little difficult to deal with once the bitumen was removed. You don't really know how that's going to play out when you're just trying to take laboratory-scale activities. You have to pilot them up and then have to go to commercial-scale. But, yeah, I guess the reality would be that this work from the late 1940s proved to be somewhat prophetic.

If you go back into the early days of the Mines Branch -- just a little more of the context -- not a lot of other research players were around. Some universities had some programs. Then, in the 1920s, you've got the creation of provincial research councils, the National Research Council, and a few other funding mechanisms. One of the things about public-sector institutions, whether they be provincial or federal or even international, is they're much better at starting new things than they are in re-steering existing mechanisms. There's just a trend to drive, for a variety of reasons, to do new things and so you end up with various mechanisms being added and layered so that the framework, if you will, for how Canadians fund public-sector research gets to be a very broad, deep, wide and confusing matrix of mechanisms. Now that's where we are today.

We spend a tremendous amount of money in trying to figure out how to allocate dollars to research programs in the public sector. A lot of effort goes into that and we keep adding new mechanisms. We don't give up many mechanisms but we sure keep adding them. Anyway, I don't want to go too far down that pathway because that's not an area that I'm really an expert in. I'm just an observer of all the things that I've seen start in my time in research in the public sector.

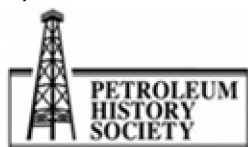
AD: Government size and, you know, we'll get back to that. I, now ...

STEWART: Let me come back to the ...

AD: Yeah.

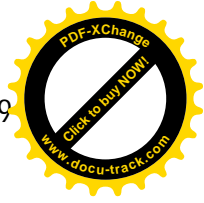
STEWART: ... the oil sands Bitumount thing. I know nothing about Bitumount so there are other people I'm sure who you can talk to that can tell you more about that. But the 1940s and the fifties and the sixties were a different era. In the late fifties, there was an interest in figuring out how to use thermonuclear weapons for peaceful purposes and there was a program established in the US called Operation Plowshare. There is information available online about it. There were a number of experiments that were actually done. They looked at a variety of ways you could use nuclear weapons as large excavating tools to build harbours, to build major road cuts. They even looked at using it in the Mojave Desert in California to create a major road cut for I-40, which is the highway that connects Las Vegas and Los Angeles. Nothing was done in that one that I'm aware of, but there were a number of underground explosions that were done, even looking at stimulating tight gas. Tight gas is common again today, so sometimes these things happen, they come in cycles. They actually did an underground test on tight gas; have never produced the gas because, not surprisingly, it's contaminated with radioactivity.

In the oil sands there was a geologist named Neufeld -- give me a second, to think about the name; anyway, with Atlantic Richfield -- or with Richfield, not Atlantic Richfield. He proposed the use of up to a hundred nuclear explosions in the oil sands and his idea was that nuclear explosions would



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reduce the oil viscosity to the point where it could be produced with conventional oilfield equipment. There was a committee that was struck that discussed options for locations. They ended up zeroing in on a place called Pony Creek about a hundred kilometres from Fort McMurray as a potential test site. At that point, the project unravelled and it never happened, but the concept to -- about 1960, was that serious consideration was given to thermonuclear uses of explosives to produce oil sands bitumen.

AD: And what period would that have been?

STEWART: Late fifties.

AD: Late fifties.

STEWART: Okay. You wouldn't, you wouldn't hear that dialogue today.

AD: No.

STEWART: Anyway, so that's just an interesting aside. There had been a lot of interest in World War II in oil sands for obvious reasons. Everybody was looking for transportation fuels anywhere they could find them. But oil sands research continued. Oil sands activities in the federal government continued in Canmet. I can remember seeing GCOS bitumen barrels in Bells Corners when I worked there in the early seventies.

AD: Because there's, you know, in terms of research, oil-sands related research in Alberta, you know, once the Blair Report, which had looked at the feasibility of taking ... Karl Clark's method, which had been finally tested at Bitumount and looking at making this technology accessible to the industry. So the first symposium in 1951, which happened in Edmonton at the University of Alberta, then was meant to hand off to industry. And so, Clark ceased to do research and there was, to my knowledge there was very little, if any ... oil sands research in Alberta in the 1950s. But, my sense is from what you're saying, is that this continued at the federal level ...

STEWART: Yes.

AD: ... in Ottawa.

STEWART: Yes.

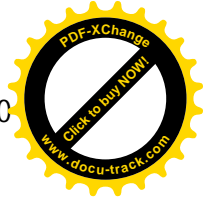
AD: And can you tell me anything about that, any specifics?

STEWART: Not a lot. I can tell you, refer you again to Alex Ignatieff's book.

AD: Yeah.



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STEWART: There are little snippets of that information in the book and that may give you enough to be able to find, through the archives of Canmet, the sources of some of those -- not publications but reports. But remember what happened in 1947. Leduc Number One came in and all of a sudden you were looking more at the conventional oil and gas business; not gas so much because there wasn't a gas pipeline structure at all in place, but we also had very cheap oil. And so, at that point, the oil sands kind of went a little bit on the back burner. But research activities did continue in Ottawa. My understanding is there were other little bits of work that were done in other places as well, but the emphasis was more towards conventional oil.

AD: And economics, of course, as ...

STEWART: The economics drove you there very quickly.

AD: Yeah, implication ...

STEWART: I mean ...

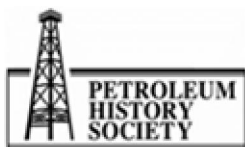
AD: ... afford developments. Now I want to go back to, you know, you've described yourself as a research scientist and that your interest is not really in ... going back to the mining specialization, that it wasn't really on the operation side, it was on the research side. And I'd like you to talk about that, I mean it's applications to coal and then eventually to oil sands and what were your motivations and interests, and how then did these experiments become a reality for the institution ...

STEWART: Okay.

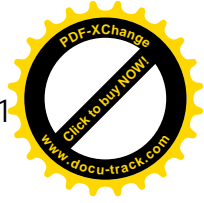
AD: ... that you worked in and ultimately headed?

STEWART: Throughout my career, I always worked with the resource industry on projects. So, for example when I was in Ottawa in the first job I had when I left university, at the Canadian Explosive Atmospheres Laboratory, we actually documented diesel-powered equipment in underground mines, monitored how the equipment was performing, so I was underground in Elliot Lake, in Sudbury and other places. So, I was connected with the mining industry but I was already pretty sure in my own mind that I didn't want to be a production mining person. So then I went to the Yukon as the Chief Inspector of Mines, obviously involved in mine inspection, obviously was in mines doing that kind of work; also was involved in the placer mining activities in the area at the time. So that was another good connection to me to the mining game.

Then I went into the Cape Breton; I was underground in coal mines there at least once a week for most of the time that I was there. Came west here; again, we were working with private-sector interests in a variety of ways, so I was involved with the coal mining industry here. I was involved in the underground test facility outside of Fort McMurray. I can't tell you an awful lot about that because the work I was involved with was more geotechnical in character than in the production area, other than to tell you it was interesting to see five-foot-long drill rods, which are very short by oil field standards, but to me were pretty typical. That's what we used in raise bores in the hard rock



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mining industry for years. So, it looked pretty much the same to me, something I'd already seen; at least something that I was familiar with.

I always had this sort of connection to the production side of the industry, but I really didn't have an interest in being there. I also had a great interest in being a manager and the director of things as opposed to just staying in the research scientist mode, and some people would say, researchers in particular, that I turned my back on them and joined the dark side and became part of the management group. But I was always able to get a lot of satisfaction behind trying to create the strategic framework that allowed other people to succeed. And that's really what I tried to do. And so what I was doing here in the oil sands game was not doing individual research projects but trying to create the framework that would allow the research activity to be successful, to make the jump to commercialization and to end up as contributing to the development of what is clearly a world-class resource.

AD: Now, the timing of the establishment of the Canmet Energy facility in Devon relates to the establishment of AOSTRA, which was the Alberta government initiative ...

STEWART: Yes.

AD: ... to promote research in all ...

STEWART: Yeah.

AD: ... in all areas of oil sands.

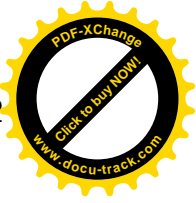
STEWART: Yeah, AOSTRA started a fair, fair bit of time before the facility here. In particular, a long time before the facility decided to turn its attention to oil sands. But we looked at what was going on; in fact, the federal government had also funded a lot of third-party groups, predominantly university groups in Alberta and elsewhere, looking at various oil production things, in particular oil sands bitumen production techniques. So a lot of activity had gone on in that area; we saw a lot of people who were actively working on the in situ issues and decided very quickly that it wasn't something we were experts in, and it wasn't an area necessarily where our skills were going to be directly applicable in the short term.

The expertise that was embodied in the Canmet people, both the people here who had worked on coal and the upgrading people in Ottawa, dealt with how to convert bitumen into synthetic crude oils or transportation fuels, or other useful hydrocarbon products and the surface and interface science that would be very helpful in terms of understanding how to deal with bitumen extraction.

Now that's not to say that we wouldn't play in the in situ game but we would be using our expertise to talk about how to do that. So if you're looking at an in situ process that provides some form of partial upgrading of bitumen to produce a fluid that's a little different -- there some chemical conversion has occurred or at least chemical fractionation or physical fractionation -- then you basically are looking at things that could be in our realm.



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Also, understand that when you produce bitumen or other oils you also produce other fluids, predominantly water -- water that's contaminated; water that has other things in it that are problematic; and interfacial science and surface science is an important part of that; so, no different than when looking at the products that are coming out of the bitumen separation process. Bitumen production fluids from in situ activities can have similar problems and we have expertise in that area.

So we intentionally went out of our way to avoid, try to duplicate anything that AOSTRA was doing. We worked with AOSTRA; we funded AOSTRA at the underground test facility, and by and large worked with them on different parts of the same suite of problems.

AD: Now you mentioned that the federal government -- I guess this would've been in the 1970s -- funded university research connected to the oil sands. Can you think of any projects and describe them?

STEWART: There were a lot of contracts let to university researchers in all variety of areas. In fact, there was an enhanced oil recovery program that was a funded program carried out by Energy, Mines and Resources at the time through Canmet Energy. I can't remember a lot of the details of that program at all. It stopped in the mid-1990s but I can tell you that there were annual reports written that would document all of the research outputs, both in-house and by contract, and I know that for a fact because I was responsible for producing at least a dozen of them here in the facility. So those things are available.

A lot of research activities at universities were used to fund grad students. Those grad students made their way into the production fields and away they go. There are connections in there that you can tease out of that information but I don't have a lot of first-hand information that I can remember. My memory's not what it used to be!

AD: Don't worry.

STEWART: I don't multitask anymore.

AD: Yeah. Well, I guess when you work in a stressful work environment, particularly one where your activities are driven by political change -- well, change in political wins, you know, there is a lot of stress. So you come to Devon and can you tell me about some of the projects that you were involved in, whether as a researcher and then as a research manager ...

STEWART: Yeah.

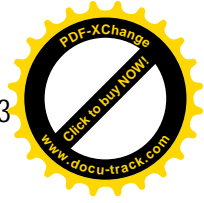
AD: ... and ultimately Director, and give -- be as detailed as possible about that.

STEWART: I didn't come to Devon to do research.

AD: Okay.



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STEWART: I came to Devon to manage other people's activities. So I really wasn't doing independent research myself. What I did do [when] I was here is I ran the mining side of the organization in the mid-1980s so I had responsibility for the laboratory that I created in Cape Breton and another group that was located in Calgary. We relocated the Calgary group here to Devon. We established a business office as we sort of migrated into more involvement with end-use people, more in contractual obligations because you're signing contracts to third-parties who are paying part at least of the cost of individual projects, and so there's all of that stuff that was being done at the time. But we really were not -- I wasn't doing research myself. I was supervising other people's activities and managing some of the business linkages within the organization here.

We did, though, put a lot of time and effort into relocating the upgrading research group from Ottawa to here to Devon and that was a major undertaking; took a lot of time and effort because, as I think I said earlier, the facility here wasn't really ready to accept them, and we had to commission the high head laboratory so that we could do high temperature, high pressure experiments at pilot scale. So that was a lot of work, lot of activity went there and in the middle of it, of course, we had the major impacts of program review, which significantly reduced public-sector federal government resources in this facility, and made us increasingly look to other sources of revenue.

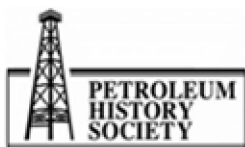
So now you're into the situation where you're basically getting part of your resources from a public-sector organization, part of your resources from different private-sector organizations, and you're balancing the public/private partnership model. And after you've done it for a dozen years, it's not too bad. The first dozen years can be a little tough.

AD: So can you tell me about some of those [activities] and the private-sector partners?

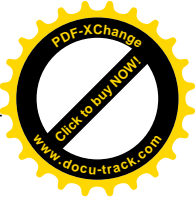
STEWART: Sure. Hassan Hamza will talk to you more about it and I would encourage you to do that with him. The Shell Muskeg River extraction process was piloted here at Devon. It was here that they were able to scale it up to the point to go to the next step, which is designing commercial scale. Okay, so it was done here in the building using the equipment in the coal preparation pilot plant area that had been modified for that purpose. We also have a froth treatment pilot plant here that was used extensively in the mid-1990s and I believe is still in use today, looking at froth treatment approaches, which is how you deal with the material that comes out of the bitumen extraction process, because what you get is not pure bitumen; you get a froth.

And a variety of different companies tested a variety of different techniques here, so all of a sudden we went from being a research organization to a group that had oil sands being delivered by truckload; bitumen froth being delivered by tanker load, and that's a little different for researchers who are not used to that kind of scale of equipment. It meant we had to develop little different skill set; it meant we needed a little different sort of an understanding of how to deal with volume because we were no longer dealing with smaller scale units.

AD: And what period was that?



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STEWART: It would've been in the mid-1990s. Froth treatment plant opened, I believe, in 1995 and I'm going to have to think a little bit about Muskeg River. I don't know when the piloting was done here. Would've been in the early 2000s I believe.

AD: So, you know, throughout the history of not only petroleum development projects, both conventional and bitumen related, there has been this tug-of-war between the province of Alberta and the federal government, and going back in time we look at the delay between 1905 when Alberta and Saskatchewan became provinces, to 1931, I believe, when they got control of their natural resources. And you talked about the government of Canada post-Confederation looking at diversification and from just being an agricultural, forestry power to then industrializing so that the federal government's stake in natural resource development was pretty significant. The struggle with the provinces around control and ownership and exploitation had implications for the research establishments that were created by the federal government.

STEWART: It did but remember at that time there was more of a disconnect, I think, between the research community and the public policy community.

AD: Okay. Do you want to talk a bit...

STEWART: It's an interesting issue. You'd like to think in a perfect world that policy would help direct research, and science and technology skills would help form good policy. That's just an obvious linkage that you'd want to have all those points of view together and that in fact is the case in a lot of places, including in Canada. But it's never a perfect connection and it's a little bit like putting economists in one room with a bunch of science techies. They don't necessarily speak the same language, and they don't even mean the same thing with words in all cases. So you have to kind of force that partnership to work a little bit. I can't really talk about the federal/provincial side of it. I always tried to stay out of the firing line, if you will. I mean I came west in 1985; the National Energy Program was a pretty raw sore in a lot of places. But we worked through that. It wasn't a hard thing to do. If people believe that you're truly there to try to help them understand more about their activity, and do a better job of whatever they were doing. And so we really tried to stay out of that political side. We got sideswiped occasionally; that's going to happen.

AD: But, you know ...

STEWART: But we never really tried to be in the middle of that picture.

AD: But it was a politically strategic decision to establish this centre in Devon.

STEWART: Yes.

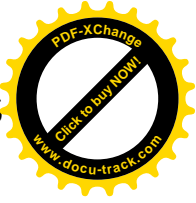
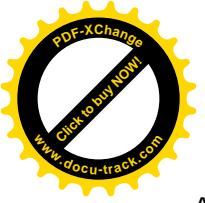
AD: Not only because, of course, Alberta has coal resources, so ...

STEWART: Mhm.



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AD: ... it made sense from that perspective.

STEWART: It almost -- well, it could've gone to Canmore.

AD: Yeah.

STEWART: In fact, Canmore was one of the towns that was considered.

AD: Why was Edmonton chosen all -- or Devon chosen?

STEWART: I believe that that would've been a decision that was made by the province, and I don't know the details of it; bound to be political, you'd think. Who knows?

AD: Yeah.

STEWART: But there were different options that were looked at. Clearly they were -- either it was Canmore or Devon; it was going to be the creation of a facility where such facilities did not exist. So there was some attempt I think to try to get everything out of the Edmonton/Calgary corridor kind of thing.

AD: Well, because of course the universities were located there ...

STEWART: Yeah.

AD: ... and University of Alberta, of course, that had an established research and development program and specialization in petroleum ...

STEWART: Yeah.

AD: ... engineering and so on ...

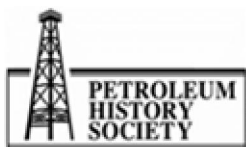
STEWART: Yeah.

AD: ... the research associated with that and, of course, then so many of the people that helped to establish the Faculty of Engineering at the University of Calgary were University of Alberta trained. And with Roger Butler then establishing the in situ program and the development of that at the U of C, I mean you did have these research....

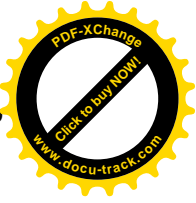
STEWART: Yeah.

AD: ... establishments.

STEWART: But remember that this was established at a facility here in Devon at a time when the concern was that we were going to run out of oil and gas relatively quickly, and we really had to get ourselves organized around finding alternatives.



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AD: Yeah.

STEWART: And this facility was intended to look at the coal alternative ...

AD: Yeah.

STEWART: ... particularly as it relates to clean coal technologies -- predominantly mining, coal preparation and high pressure, high temperature conversion processes. So that's really how this facility started, okay. It was never thought that it would be an oil sands research facility when it was constructed. But other circumstances led us into the oil sands pathway. And one of the other reasons that strategically we thought the surface mined oil sands was the place for us here in Devon was that there was only really very limited industrial-scale expertise available. There are two mines in the world mining oil sands and putting it through an extraction process.

AD: At that time.

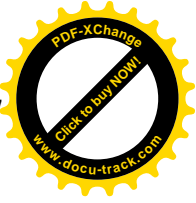
STEWART: At that time. That was it. So you couldn't run around very far and look for expertise, so we tried to create here a facility that would allow new entrants into the business to find a source of the skills they would need to understand how their process could work. Okay? And it worked. I mean that's when Shell came here -- Shell piloted Muskeg River here and away we went. So to some extent that strategy proved to be right. Now there's lots of people who want to take ownership for strategies that have proved to be right, and there's lots of orphan strategies that didn't work, okay? So I don't want to say that we had a dead right and were perfect, but the strategy was to provide a mechanism by which new entrants had a chance to come here and gain science and technology understanding on how their process could work at a scale that was relevant to the decisions that they had to make as they grow into a commercial-scale possibility. So that's on the one side.

On the other side, in the early years of bitumen production and synthetic crude oil production, a lot of refineries had some problems dealing with bitumen-derived crudes. That's because they're a little different. So there was a lot of misunderstanding about what you could and couldn't do in a refining context with bitumen and bitumen-derived oils. So we set up within the National Centre for Upgrading Technology here at Devon a lot of effort in trying to make bitumen become an understood mainstream crude material. So we were involved in a lot of the chemistry, round-robin experiments. When people were looking at different transportation fuel options, we made sure that synthetic-crude-oil-derived transportation fuels were included, and we tried to demystify the chemical conversion issues surrounding bitumen. And, by and large, I think we did a job there as well that has turned out to be fairly positive. No longer are a lot of refineries afraid of bitumen as a feed stock; they're just more interested in how can they blend it into their feed stock to maximize the use of -- into the feed stocks they use to maximize the products that they produce.

But that wasn't the way it was if you go back into 1985 to 1990. At that time, there was not a broad understanding of the differences and of ways that you could actually successfully use bitumen and bitumen-derived crudes.



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AD: Do you think that the importance of this facility increased once AOSTRA was effectively shut down? I mean it took a number of years to shut it down completely, but you know, for economic reasons, and also because so much had succeeded, there had been so much success. The...

STEWART: Okay.

AD: ... provincial government decided to ...

STEWART: Yeah. But AOSTRA was a funder of research ...

AD: Yeah.

STEWART: ... more than a performer of research.

AD: Okay.

STEWART: Okay, this place was set up as a performer of research so it was never really that big a connection in that sense, although we did co-fund with AOSTRA. We had a lot of interface with people who worked for AOSTRA. We had a lot of discussions with people who were working on AOSTRA-funded projects, but the reality was that AOSTRA never did fund a lot of work here and that was okay. We basically looked at the AOSTRA experience when we decided to become part of the oil sands research capability, and looked for niches that we thought were not being adequately addressed.

AD: The -- and maybe you could summarize again what those issues were, that then were the driving force for the development ...

STEWART: Okay.

AD: ... of, of programs and initiatives here.

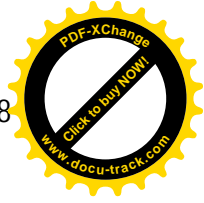
STEWART: Okay. Do it in two pieces. The National Centre for Upgrading Technology, which is the chemical conversion side of it is one piece. Let's talk about the other side of it first and that would be the advanced separation technologies group that Hassan Hamza was the manager of when I was the director. Hassan is now the Director General of the facility here and he can talk at more length about what they were doing, but what they were looking at was the skills that they had in surface and interfacial science ...

AD: Okay.

STEWART: ... and understanding aqueous-based systems and looking at how to apply those to the bitumen extraction process and as it relates to surface-mined oil sands; also how to apply that to the produced fluids from in situ production facilities. Not the in situ process itself but the fluids that come out of the ground. Those skills were rooted in coal preparation and an understanding that



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Canadian, Western Canadian coals, in particular, are friable; they have high clay contents, and so understanding how fine particles interact with water is a really big deal. Exactly the same issue as it relates to bitumen extraction. So that's the advanced separation technology side of it.

We also looked at tailings; we looked at recycled water because there are issues -- or there were issues and I assume there still are -- in water quality as it relates to recycling and whether if, in fact, you end up creating more problems for yourself through the recycling mechanism by concentrations of various ions changing, getting higher or whatever.

All of those activities, as I understand it, are still going on. I have not been involved in this facility for nine years. Okay, I've intentionally tried to not be involved because I've never thought it was appropriate for the boss to come back and tell the new boss what he's doing right or wrong. So I had my chance; I made the changes I wanted to do here, and then I walked away.

The upgrading side is understanding all of the activities that occur in a refinery or an upgrader to get you to the point where you've got a bulk fuel or a bulk chemical that's available for sale. And so all of those skills had been running in Ottawa on programs around bitumen and bitumen-derived materials and came to Devon. [They] spent a lot of time getting organized out here, getting all set up, commissioning this facility and then starting to run programs. And, again, Bill Dawson is the person who actually came from Ottawa as the first manager of NCUT [National Centre for Upgrading Technology], and can talk more about it.

NCUT was a neat model, different kind of model. It was a federal/provincial partnership. It brought Provincial Research Council employees and the federal government's research people together under one roof on one program, managed jointly by the province and the federal government. It ran for 15 years; it was not renewed. I understand there is a new mechanism that was announced in the last year but I don't know much about that. Again, Hassan would be able to tell you, and there are press releases out there that will talk about the Alberta Innovates ...

AD: Yes.

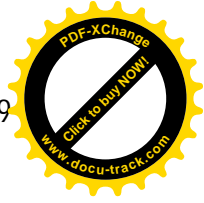
STEWART: ... and NRCan program. I think it was announced early in 2012.

AD: What's interesting is that in the era where you were involved as a manager and then the Director and Director General that the issues, the hot issues, were around improving extraction and processes to create marketable products. Of course, now you drive to the facilities and the first thing that you see is that it is tailings and that now that has become a huge, a huge driver of research interest.

STEWART: I may have misled you if you didn't get the impression that tailings were always important to our research program here. Tailings were a major research activity. Other people have talked, I believe, about Conrad, okay. There was a major fine tailings consortium in Conrad. We spent a lot of time and effort trying to understand fine particles in water and that's what tailings is. I mean the sand fraction is never problematic; it drops out. The problem is the fine colloidal clays



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and the little bit of oil that's left, and the water and the dissolved materials in the water in the aqueous phase that effectively prohibited or prevented those fine clays from settling the way you'd like. So a lot of activity in this facility went on in looking at ways to ameliorate existing tailings problems, and how to prevent them being formed in the first place.

AD: Now, in terms of private sector projects around that, can you give me any examples in your era?

STEWART: Sure. We actually did experiments here at how to settle fine clay problems. And so we were looking around for relatively inexpensive ways of buying pilot-scale equipment that you could use as a little tailings pond. So we ended up buying a bunch of kid's swimming pools. That's not something that research organizations usually buy, so when we bought those the question was asked, "Why do you need kiddie pools?" So told them the answer and then they went away. But that's just one example of where before you go to the field to try something at large scale, you try it in a lab first. You try it on a bench-top and, if you can make it work on a bench-top, then you go to a little bigger facility and the bigger the facility in this case was kiddie swimming pools, trying to see how this technology would work at that scale. And what you learn from scaling it up, you then take to the field in a field pilot before you try something at a larger commercial scale.

AD: So what was done with these kiddie pools?

STEWART: We put tailings in them ...

AD: Okay.

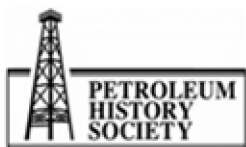
STEWART: ... and solidified them; exactly the same process that you do at commercial scale, but nobody is going to go from test tubes to commercial scale. There are steps in the middle because you do find things as you scale up that behave a little differently than you would've expected from the fundamental chemistry.

AD: And so what did you discover then from creating these mini tailings ponds in kiddie pools?

STEWART: Well, what we were basically doing was trying to figure out how to cause these clay particles to coagulate together and form a semi-solid much quicker, and basically it worked. And so you've got technologies available that may or may not be economic at some point and then you basically work your way through the economics with the private sector because they're the ones that understand how that works, and if you look now at tailings comparisons to what they were in the late 1970s or 1980s or even early 1990s, there's been a tremendous improvement. And we have been in the middle of that since day one.

AD: Okay, so ...

STEWART: Day one to us in oil sands.



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AD: Yeah. Is that the whole dry tailings thing or is that ...

STEWART: I don't know.

AD: Okay.

STEWART: I haven't, I haven't been involved in this for nine years.

AD: Yeah.

STEWART: Okay, there are other people who can tell you how it's moving along ...

AD: Okay.

STEWART: ... but the intention has always been to get tailings ponds to a point where they can be abandoned as solid land. I mean that's what everybody always wanted. It was a problem because of the fine clays that were defying settling.

AD: Settling, yeah.

STEWART: They just didn't want to settle and there's a bunch of reasons for that that people can talk to you about. I'm not an expert on that field, but it had to do with the fact that there was almost a stabilization mechanism going on between the ions in the water and the clay particles themselves. So it just stayed as a stable emulsion almost.

AD: Now ...

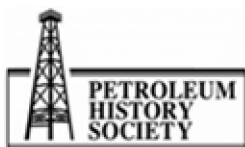
STEWART: I can give you a simple example of that if you want.

AD: Please.

STEWART: You go into a grocery store and you look at salad dressings. There's all kinds of oil and vinegar salad dressings. Some of them are clearly in two phases where the oil and the vinegar have separated. Others look like a single phase because they are in emulsion, an emulsion that is stable because it wasn't stable as they sat on the shelf for weeks or months or whatever. They would've separated. The fact that it hasn't means that there's something that's preventing those two materials that are not really miscible in each other from separating. And that's the difference between a stable and an unstable emulsion.

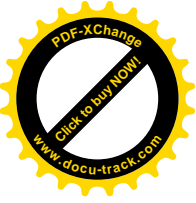
AD: Now what is the relationship of Canmet to research establishments, say at the University of Alberta and the University of Calgary? Is there a relationship?

STEWART: There always has been. Canmet not only is a performer of research but is also a funder of research. And predominantly the funding that Canmet provided went into universities.



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There are a lot of joint projects; there's a lot of interface and interactions between individual scientists. I can't tell you the current status because I've been gone for a while but ...

AD: But in your ...

STEWART: ... there actually -- well, and it happened when I was still here -- there actually is a University of Alberta Tailings Research Facility located here in the centre.

AD: Okay, and that's the sign ...

STEWART: Okay.

AD: ... that I saw outside.

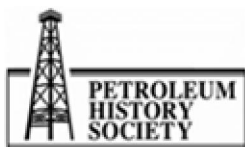
STEWART: Yeah, and what you've got is a lot of other individual project linkages as well. I can't talk to you about them other than what they were doing in the early 2000s. But Hassan should be able to address that in more detail. We have always thought that to be successful as a research centre in the federal family you've got to be linked locally, linked regionally, nationally and internationally. And so those linkages have always been important to us. They're also crucial to scientists because scientists really need to get an understanding of what their peers think about their work, and that interaction between scientists is important.

AD: Would it be fair to say that, you know, university research establishments do sort of pure research and that with respect to this facility it was really interested in applied research and then these collaborations with research establishments at universities?

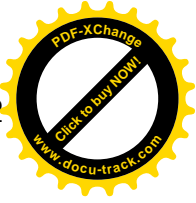
STEWART: Okay. Technology has changed; when I started in the federal government, Canmet, or the Mines Branch as it was known at the time, was a research and development organization. So that means research and then development implies a commercialization pathway. It's changed now to science and technology. Other people call it science, technology and commercialization, but we have always been, in the Canmet family, looking at ways to use technology and science to improve commercial-scale stuff. So we've always had that end-use bias, if you will.

AD: Yes.

STEWART: Universities by and large started out as teaching facilities. A lot of them now are major research providers but they are still doing that research predominantly through graduate students. And so graduate students are there for a while, then, they go on and do something else. It's a blurrier line than it used to be. Everybody is chasing money in the research game from a variety of pools, and the one pool that everybody has spent more and more time on in the last 20 years is the private-sector pool. If you go back into the federal family in the 1980s, more and more strength was put onto commercial linkages, end-use exploiters, commercialization. How are you going to get the knowledge that you've got converted into something that people can actually use? And so more and more attention was put into that area, and that's not a bad thing as long as you don't get yourself so



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far down that pathway that all you're interested in is picking cherries off trees. The reality is you can do some cherry picking but somebody has to plant the trees.

AD: Well, you know, in the period 1980 through '84 when I was the science and technology editor of the *Canadian Encyclopaedia*, the buzz word was technology transfer from, you know, government and university laboratories to industry so that you really -- that became a policy focus...

STEWART: Correct.

AD: ... whatever the terminology is today, but it was intended to build the economic might of the country to generate jobs ...

STEWART: Yeah.

AD: ... I mean all of those ...

STEWART: Yeah.

AD: ... all of those things.

STEWART: Yeah, you're making investments in public-sector research ...

AD: Yes.

STEWART: ... and science ...

AD: Yeah.

STEWART: ... with some expectation of something happening as a result of that.

AD: Yeah. So this facility was certainly envisualized -- envisioned, sorry, not a word -- as doing, as doing that.

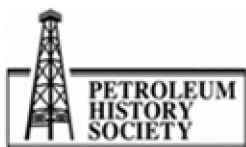
STEWART: Correct.

AD: I'm wondering now about what the annual budget was of the facility in the period that you were involved in it and how much of the budget was used to fund research in -- you know, you mentioned that you were a funder at universities ...

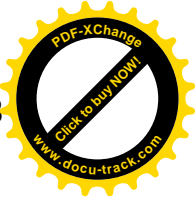
STEWART: Okay.

AD: ... versus how much was actually used to run the research in this facility.

STEWART: In this facility?



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AD: Yeah.

STEWART: I haven't looked at budgetary numbers since the day I left. Okay, so it's been a while. This group always had more money devoted of the total resource pie that it had available to it to doing research than to funding research.

AD: Okay.

STEWART: We were always more of a research provider than a research funder.

AD: Okay.

STEWART: We used our contract -- we called it contracted out or externally delivered research funding to do a couple of things: pursue interesting opportunities in areas that we thought might become important down the road where you could go out and gain something from the expertise of someone elsewhere who was in a field that you weren't really yet involved with; some of the biotech stuff comes to mind there. That's one area.

The other area was to say "Well, we don't really want to spend the time to do this fill-in work that we know needs to be done, but we know these guys can do it really well so let's get them to do it." It's more efficient that way. But we were predominantly, since the inception of this facility, a research performer.

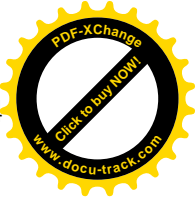
Now there were additional complications to that, particularly in the 1980s because David Brown, who was the director here at the time, was sitting on the Alberta Canada Energy Resources Research Fund, which was allocating lots of money to research in a variety of places, including in this building because this building housed the Alberta Research Council Coal Program and a made-in-Alberta entity called the Coal Mining Research Companies Activities. David Brown is in a better position than I to talk about those and I would suggest that you do that with him. So what you end up with at that time was a lot of money through this funding mechanism that we really didn't manage. We were sitting as part of a management team that included Alberta government interests in deciding how it was spent.

When I was the director here, I also got involved in the creation of the Petroleum Technology Research Centre in Regina, and that was a funding mechanism. I tried very hard to make sure that it didn't happen at the expense of this facility and was able to find other ways to fund it in a way that didn't penalize this place too hard. But the reality was we were going to create a research capability there, and so we became a funder of that activity in its early years.

AD: Did you envision when you did that that there would be oil sands development in Saskatchewan?



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STEWART: There already was heavy oil development in Saskatchewan. And if you drive around that part of north-western Saskatchewan where that was happening, they were producing a lot of sand. That's just the way those wells work.

AD: So that ...

STEWART: So they had ...

AD: ... so then did that build a capacity at the university there? Was that intentioned as well?

STEWART: No, it really wasn't heavy oil driven. There was a heavy oil component in it but it was Saskatchewan oil and gas driven, and early on the opportunity came along for the Weyburn carbon dioxide flood that allowed us to get involved in a project where we could look at CO<sub>2</sub> injection. The company's looking at it from the perspective of oil production. We were really looking at it from the perspective of "This is an opportunity to have a really good look at a possibility around geological sequestration of carbon dioxide."

AD: So you got into the carbon capture business.

STEWART: Not carbon capture. Well, okay, if you call that. My view of carbon capture is ...

AD: Yes.

STEWART: ... that's taken out of a flue gas.

AD: Yeah.

STEWART: Okay.

AD: No, it's ...

STEWART: We're talking about storage in this case.

AD: Yeah, sequestration.

STEWART: It's called sequestration or storage.

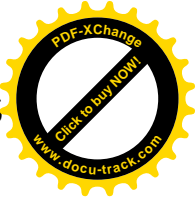
AD: Yeah.

STEWART: And so the International Energy Agency got involved -- was a very large project; there's a couple of books that are available on it. There's lots of information out there, both in the IEA and in the Petroleum Technology Research Centre if you want to get more about that.

AD: But did any of that work ...



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STEWART: But clearly was a ...

AD: Sorry, finish.

STEWART: It clearly was a world-class big project.

AD: And was any of that work done here at Devon?

STEWART: No, I don't believe so.

AD: It was done ...

STEWART: It was, well, it was done all around the world, and the Encana facility in Weyburn ...

AD: Yeah.

STEWART: ... was the provider of a lot of the information. It was just a glorious opportunity to see what we could learn about storage.

AD: So, you know, in your years as Director, what was the size of the budget that you were managing nat ...

STEWART: Okay.

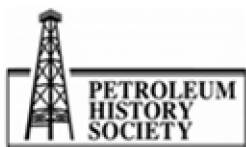
AD: ... or annually, if you can, if you can remember.

STEWART: I'll give it to you two different ways. I'll give it to you in number of people.

AD: Okay, that's great.

STEWART: Okay, people on site, about 120 is my recollection; all in budget number, about \$15 million -- upwards of \$5 million of that from private-sector sources. And that was going up all the time. I don't know what it is now. So it was a kind of a blend and I always, strategically, worried about the fact that if you get to the point where the majority of your resources now start coming from the private sector, you are having a greater and greater problem dealing with public sector good. You get driven more down the pathway of the private-sector interest. Not that the two can't coincide, and we always tried very carefully to work on that, you know, interface between the two interests, but it was an interesting dilemma.

Clearly, if you are totally dependent on private-sector funding, public sector good is not real high on your priority list. Clearly, if you are a 100 percent government funded, public-sector good better be a driver. But, in the middle, it becomes a bit of a compromise. So we manage that compromise; we did the best we could. It was an interesting transition.



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AD: Well, you know, this is an issue really in ... every generation. You know, now we're into a cycle again of both the provincial and federal government looking at, you know, value for -- for dollar and looking at having expectations of any funding that they provide to university research establishments and to research establishments such as this one and, and you have critics saying that well, if it's only going to benefit companies, you know, and the ...

STEWART: Yes.

AD: ... company bottom line, they should ...

STEWART: Why?

AD: ... do the research. Why should government ...

STEWART: Yeah, why is it being done by the public sector?

AD: ... fund it at all?

STEWART: Yeah.

AD: Now, you know, you were in the public service for ...

STEWART: 31 years.

AD: ... exactly, 30 years and so do you want to talk about that? Government-funded ...

STEWART: Sure.

AD: ... scientific research ...

STEWART: Sure.

AD: ... and policy directions -- the swings and the roundabouts.

STEWART: In case you haven't figured it out, I've got a few opinions.

AD: Yeah, it's a good thing.

STEWART: I'll start with one that I have always thought was a problem and you understand that in the public sector you fund a lot more than applied research activities. There's a lot of social science and humanities work that's done, okay? And social scientists compete for tiny little bits of money, spend years writing their proposal, have to defend it heavily; they go through all kinds of hoops to get a tiny little stipend so they can do some work. I don't think that makes good sense. I actually believe it makes better sense to allow researchers -- or sorry, university professors to have their federal income taxes rebated to them to fund research. If they choose to do it that way, and if they



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do choose to do it that way, I want the university accountable for how those funds are spent and to have some form of audit in terms of what's done with it; some form of peer review, financial and otherwise.

The reason I'm saying that is I think it's just terribly, terribly destructive to spend all that time and effort writing proposals when you could be doing work. That's a personal view. Don't -- it's not a policy view of any organization that I ever worked for, but I think there's some merit in looking at ways like that, that would allow you to unwind all these terribly bureaucratic processes that are surrounding the allocation of, in many cases, tiny pots of money.

With that said, let's talk about Canada as a nation. Canada is a small provider in the world's science and technology game, okay. For Canadians, you really want to work on things where you've got some form of natural advantage. Either the advantage is you own the resources, or there is some compelling reason why the resulting technologies would want to stay and benefit Canada. In the oil sands business, I think it's a pretty clear argument. The oil sands aren't going to get up and go to southern California. They are here, okay? They are going to be exploited here. They're going to be developed here and you'd like to hope that all the economic advantages of that development stick here.

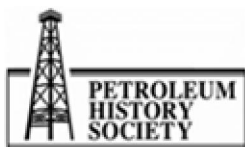
Let's talk about coal for a second. The world burns about four and a half billion tons of coal a year. Canada burns, mm, good question; don't know; can't remember the number now. But it's in the tens of millions of tons a year. So it'd be a little foolish for Canada to set itself up and say "We are going to become the coal combustion experts of the world." There are other people who have much more skin in that game and are going to do it, and we're going to capitalize off those advantages.

I make the same argument about biotech. A success in biotechnology, whether it's pharmaceutical or otherwise, is going to tend to migrate to areas where major companies are exploiting those developments, and unfortunately that's by and large not in Canada. So in many cases you can start out with a really good idea and a really good technological success, only to see that the commercialization pathway slides out the door and somebody else gets that advantage. And you can't always predict that, but what I'm saying is be honest with yourselves and understand your capabilities, understand what is the "Canadian niche;" understand what is the Canadian opportunity and buy us your investments in areas that make sense. Clear?

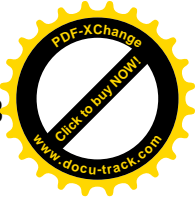
AD: Yes. So in other words, it makes sense to continue -- for the federal government to continue to fund this facility because it is -- Canada has international expertise. And, in the AOSTRA era, Clem Bowman and others were participating in international conferences; they had strategic alliances ...

STEWART: Yes.

AD: ... in Japan and Russia, in Venezuela, wherever. I mean, and so ...



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STEWART: Yeah, and all the research organizations, if they pretend to be national, credible facilities have those kinds of linkages. They have to.

AD: Yeah.

STEWART: Nobody has a corner on all the good ideas.

AD: But then ...

STEWART: Or all the expertise.

AD: ... but then we get the issue of the vagaries of funding that basically has to do with GDP and global recessions and ...

STEWART: Yeah.

AD: ... all of those things.

STEWART: And those are going to happen, okay? But what I'm saying is if you are really making conscious decisions in funding areas of research and technology development that are likely to stick in Canada, it's easier to argue for some patient funding and it's easier to argue for some maintenance funding when times are tough. What kills research programs is the "boom and bust" cycle of funding. It just destroys them.

AD: Well, and I was going to bring up an example. I interviewed David Schindler and, of course, you know, you're aware of his work, the freshwater lakes, the research centre and everything else, and ... he talked about why he then came to the University of Alberta and it's that same era of program review and cutting of research scientist positions; you know, his claim, which I'm sure is true, is that the growth in the administrative level in many of these facilities and then ultimately we saw this past year discussion that that institute was going to cease to exist.

And so it's the politics of funding; it is the ... the flavour of the month kind of funding and so we see this in terms of the invention of entities and also the agreements between the federal and provincial government. And do you want to talk about some of these overarching issues in your era?

STEWART: Yeah, I really wouldn't like to but I will.

AD: Go for it.

STEWART: David Schindler I can't really address ...

AD: No, no.



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STEWART: ... I'm not close enough to ...

AD: I'm just giving ...

STEWART: ... that to understand.

AD: ... that as his perception.

STEWART: And, as part of his perception, I understand what he's saying about less of the dollars are going into research and more of the dollars are going into bureaucratic pursuits. That's a reality when you start getting money from a whole bunch of different places, and a whole bunch of money with different strings on it. All of a sudden you're forced to deal with all the different accounting approaches that all these different people want to use. So there's an inherent problem with that model. Okay, you need to understand that model and you need to understand the bureaucratic level that you're imposing on people.

But, with that said, the basket of dollars approach to getting projects done I think is a good one because it forces a lot of differing interests to the table who all come with a different perspective and help steer the project in different ways that optimize the opportunities to success and end-use. So it's not a bad thing totally, but you've got to control the bureaucratic beast, there's no question about that.

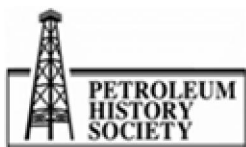
The reality in our political system is that politicians like to announce things. That's an important thing if you're a politician. And politicians don't like to announce old things or somebody else's idea; they like to announce new things. So in a lot of cases you're faced with a situation where you need to come up with something new and that's part of the driver in our public sector at different levels in Canada that lead you into saying "rather than fix an existing mechanism, let's create a new one. There's a driver in that direction." I don't know how you get away from that. You could, I suppose, if you could get people to ever to agree to this, if you're going to propose something new, give up something old. And that's when you find out how many people really think the old stuff is okay because there's a tremendous inertia in most systems to keep things going that are existing; as well as create new things and that's life in our political system. That's the way it works.

My view is that that's really not going to change very much; we are going to be addressing this sort of every ten years or so, a new approach to how the governments at the various levels are going to fund strategic science and technology in the public interest. We're also changing in some definitional senses what we mean by the public interest.

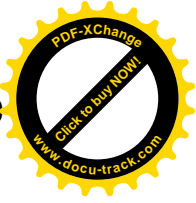
AD: Well, you look at the terminology of, you know, the "license to operate," which now business is charged with ...

STEWART: Yeah.

AD: ... that attempts to bring the public good into the equation.



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STEWART: Correct. Yeah. It used to be much simpler. You got a royalty and that was the public good. That's no longer sufficient, so it's a more complicated bottom line discussion than it used to be, particularly if you went way back. Yeah. What I'm interested in is seeing mechanisms that we can get a little more coherence in funding envelopes that go over longer time-periods so that people can make sensible strategic investments, in particular, the people and equipment.

AD: You know, looking at what governments did, they acted as if these activities like of the Mines Branch and in this facility were de facto in the public interest because they resulted in the growth of industry, job creation, all of those positive things. In the last 10 to 15 years with a rise of a new generation of environmentalism, it's a different world -- that governments' responsibilities and just to help stimulate ...

STEWART: No, and it hasn't been for a long time.

AD: ... growth. Yeah.

STEWART: There's always been a concern about environmental implications of development.

AD: Yeah.

STEWART: I tend to believe that there is no development without some environmental implication, but what you're really trying to do is balance those things. I always called it a triple bottom line. You're looking for jobs; you're looking for growth' and you're looking for either environmental improvement or sustainability or some buzz word, whichever one you wish to use that describes that environmental lobbies, attempts to manage a planet that we can leave to our children in a happy sense.

AD: Was that a part of the vision of this facility as ...

STEWART: Yeah.

AD: ... as well?

STEWART: Yes.

AD: Can you give me some example?

STEWART: Well, the whole idea behind the creation of the facility as a coal research centre was to look for ways that we could broaden the fossil fuel supply in an environmentally more sustainable way. Okay. When you're dealing with non-renewable resources, at least non-renewable in the geological timeframe of oil and gas and coal, you have to be a little careful about how you describe sustainability because at some point you're going to run out of either economics or you're going to run out of resource. But the reality is that's a long way away. And so what you're looking at is, really how do you use these things as dominant sources of energy today as the world migrates to a



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much more diverse energy future. Okay. You can't just all of a sudden assume that all cars will be powered by clean electricity; got to figure out what clean electricity means first of all, and you have to understand life cycle implications whatever you do. But the reality is the world's energy future is going to be a much more diverse energy future than it even is today and it's much more diverse now than it was 50 years ago.

And that's the way we're going to go and so question is how do you capitalize on what you've got and build bridges to this new future. And I've always looked at the non-renewable fossil energy business as we're making investments in wind and solar and everything else we can think of because we know we're going to need them down the road, but things like oil sands is the bridge to whatever that new energy future in the long-term will be. We can't just stop what we're now doing; we've got to figure out how to migrate and transfer to something else.

AD: Well, you see ...

STEWART: And we've got huge investments in energy infrastructure. We have the ability to send electrons by wire; we have the ability to send liquids and gases by pipe. We have to figure out how to use those systems to our advantage because we can't all of a sudden invent a new energy carrier. We can't afford the infrastructure cost to build it.

AD: It's interesting -- nobody has used that term describing the oil sands development as a bridge to another energy future alternative ...

STEWART: Wow.

AD: ... energy ...

STEWART: Yeah.

AD: ... whatever.

STEWART: But I'm talking maybe a 150 years here, I mean it's a long time out.

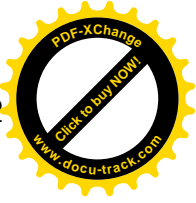
AD: Yeah. Yeah, so it's ...

STEWART: But there's no way that a 150 years from now we're going to have the same balance of energy sources that we're using today. There's going to be different stuff. The question is -- how do we get there without freezing in the dark; and oil sands, I think, is an important part of that.

AD: Now, you know, someone who has spent a significant part of his working life managing oil sands related research, how do you respond to the charges made by environmentalists about "dirty oil" and not only the geographic footprint, carbon footprint, any of those things that cast doubt on further development of the oil sands?



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STEWART: Just split it into couple different pieces.

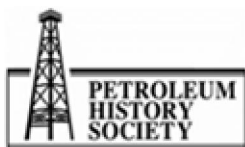
AD: Yeah.

STEWART: Okay. I have always believed that if you are looking at environmental implications of a technology or a development, you need to do so, on a life-cycle basis. So it's not just the energy inputs into producing a barrel of oil that's important. It's how that oil is transported and how it's used as well. So that's what I mean by life-cycle arguments and if you look in a life-cycle basis, there's no doubt that oil sands is a little more energy-intensive than light crude oils. But not that bad, and if you look at the technology improvements that are happening over time, you can see that shrinking. Okay?

You have to recognize as well that the surface-mined oil sands industry is still a new business. If you look at the number of collective years of commercial-scale operations, it's just a tiny number in relation, for example, to other resource-based industries. Copper mining, iron ore mining, coal mining, all of those things have many, many more years of operational experience in a whole bunch of different places. So the opportunities to make improvements in oil sands is much more significant than it is in those other areas where the large number of operations that have been running for many years have already taken out most of the optimization opportunities, or many of them. So don't despair, oil sands is going to get a lot better, okay. That's the first argument I would make.

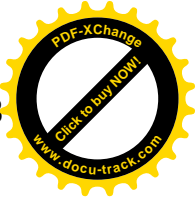
The second argument is around a surface-mining argument and that is that when you're in the middle of surface mining you do make a mess. You have a big hole in the ground. You have a tailings pond; you have all those things. That's inherent in surface mining. You have to understand, though, that in the modern context that is a temporary land use. That's not the end use. The question is, what are you going to leave when you're done? How do you ensure that there are sufficient resources available to make that recovery work and what is the timeline of it? And, if you look at that there's been significant improvements in that as well, not the least of which is the migration of tailings into stuff that is much quicker settleable and is going to be rehabilitable much faster than before.

The other thing I would argue -- I wouldn't argue, I guess I would say, just comment about, is that you need to also understand what are the attributes of the landscape that you're leaving behind? And, in some cases, the landscape that you're leaving behind may be more attractive. When I was in the Yukon, we looked very hard at some of the old dredged creeks in the placer gold area. It's the same kind of issue. You've turned the creek bed upside down -- or they did a 100 years ago or 90 years ago, or whatever it is now. And if you talk to people who live there now, the old stunted Black Spruce permafrost zone is gone and down in the disturbed valley where the dredge was, you now have alders and aspens, grasses growing because all the permafrost is gone; you've turned the soil upside down and now they have moose coming in and eating the stuff and they're shooting the moose and they're eating the moose and, frankly, they're pretty happy about that. From their



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perspective, they actually think that this valley is a more useful thing for them than the original valley was.

Now, there are always going to be people that say that's not true, okay. But have an honest think about what you're going to leave behind at the end of what is a temporary use, and then decide whether it has value or not. If it has some less value than the initial structure, did the development and the value of the development more than offset that; because we are never going to be in a situation where you can have development without implications.

AD: And I guess that's ...

STEWART: Okay.

AD: ... that's what's lacking in ...

STEWART: Yeah. Many people look at prairie farm land as what a marvellous thing this is. If you look this time of year in Alberta you've got these one-square-mile big, yellow fields of canola. That is the most disturbed ecosystem in the world. You'd never in natural history find a mono-species surrounded by a gravel berm, which we call a road. Yet, we don't complain so much about that. It's just we're used to that because, whether we know it or not, way back sometime in the past, we were all farmers; because you had to grow stuff to eat. But you're hard pressed, and I'll say it again -- you're hard pressed to find a more disturbed ecosystem than a well-managed farm field.

AD: Monoculture, I mean all ...

STEWART: Yes.

AD: ... all of that.

STEWART: Yeah; nothing but that plant in that square mile.

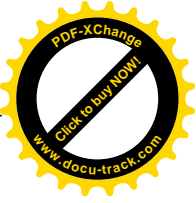
AD: Do you think that the industry and, again, going back to oil sands and government -- have effectively lost the public relations war?

STEWART: Be a little careful here how I answer that. On one hand, large organizations get so invested in what they're doing that they become a little defensive when they get people taking them on, and it's no different than the nuclear people, for example. Large, large companies get terribly invested in what they're doing and they really do try hard to do it right. And so you end up sounding defensive when you're trying to present your argument; and that kind of puts you behind the eight-ball right away.

There is no doubt that surface-mined oil sands is not necessarily a pretty photo op, okay. So that's another one that puts you behind the eight-ball. I don't think you give up. I think you keep coming back and, yeah, I think you come back in a whole variety of ways that start by first of all



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understanding what your opponents are thinking, because if you really haven't walked a mile in their moccasins you got a problem. And once you understand what they're thinking, then, you can try at least to come up with arguments that explain what is happening here, what is going to happen in the future, and what the end product's going to look like. It's not easy. It's never going to be easy, but that's why you have PR relations firms.

AD: Now, but of course those things impact on funding and programs within ...

STEWART: Yes.

AD: ... facilities such as this.

STEWART: Sure they do. Sure they do.

AD: And so, you know, we've seen Conrad, you know, we, the -- now see COSIA [Canada's Oil Sands Innovation Alliance]; I mean these entities, and then federal/provincial agreements that [focus] around water and ...

STEWART: Yeah.

AD: ... and so on that then impact in the way that the research dollars are allocated and what facilities such as this do.

STEWART: But what I think is the migration you see from Conrad to COSIA to whatever's going to happen in 15 years' time --because it'll be something else -- is more a manifestation of the need to create new things rather than fix ...

AD: And for the Minister ...

STEWART:... existing things.

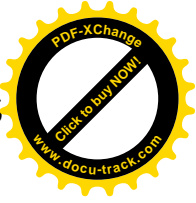
AD: ... you know ...

STEWART: Well, whether it's ministers or other people, but it -- everybody has an innate ability to think they've got a better way to do things; that's just the way we are, particularly in the science-scape. And so you try to ... you like to create new things as opposed to fixing what's already gone on. So I think the fact that you've got these changes in names and acronyms and whatever, that's going to continue to happen.

The ebbs and flows of research funding is a different dialogue, I think. And I think in part that's because we have never done a very good job of communicating why it is we're doing it; what there is about this particular package of research money that's really important in the long term; and if you don't have those kinds of discussions you tend to migrate towards research projects that sound good. You know, "because the Germans are doing it" or "because look at all this work that's going



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on in Louisiana here. Why don't we do that here?" Well, if it's going on in Louisiana it means they got a little different climate than we do so maybe it's not going to work so good here. And you don't have those dialogues; it's kind of following the leader things. And I don't think Canada can do that. We're too small a player; we've got to be more selective; we've got to make sure that what we do do, we do well; and that means you can't starve everybody. But some people are maybe going to get told that this is not a priority.

So prioritization I guess is what I'm saying in a way and understanding how you make successful long-term research programs work, and that's not the cherry picking model because somebody has to plant the tree.

AD: Yes.

STEWART: Okay.

AD: Now, would you say that this facility was also a part of the federal government's Western Economic Diversification Strategy?

STEWART: That's a good question. I don't know the answer to that one. I don't think it was. What it was, though, was a conscious knowledge that if you're going to be a national player like the Mines Branch or Canmet is, you can't have all your research done in Ottawa. You've got to sort of migrate things out. So you've got the facility here; you had the facility that was established in Cape Breton; you had other facilities that were established elsewhere. I actually believe there's a pipeline group that used to be in Ottawa that is now in Calgary. I don't know anything about that because it happened after I left. I know that the metals research people that used to be in Calgary are in the middle of, or have moved into the Hamilton area; McMaster I believe.

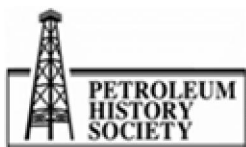
So, yes, the reality being that if you have all your researchers in one place, it's hard to reach out to the country, and there are lots of examples of models like that that have worked in the federal family in the past -- there's agricultural research stations all around the country; forestry research centres as well, for the same reason.

AD: Well, and I think that, I mean in terms of the mines and minerals and so on, which the Mines Branch and its various incarnations was charged with, I mean, initially it was central Canada dominated as were the research establishments, but then of course the government realized that regionalization -- maybe Western Economic Diversification is one angle, but also it's regionalization initiatives.

STEWART: Yeah, I'm happy with it as a regionalization discussion.

AD: Yeah.

STEWART: And you've got to understand that in central Canada there's no coal.



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AD: Yeah.

STEWART: Okay. The coal is on the east coast and the coal is in the western provinces.

AD: Yeah.

STEWART: And so for -- from coal -- Canmet has always had a coal program.

AD: Yeah.

STEWART: The coal program has always been regional but, in many cases it was delivered by people who came from Ottawa, and that's an impediment. It's harder to make good connections with folks on the ground, who are working in the industry, if you've got to travel long distances. So early on there was a coal research, mining research group in Calgary.

AD: What's interesting is, again, it's been ...

STEWART: The coal preparation people are in Edmonton ...

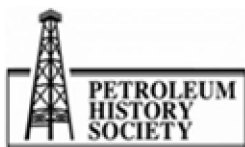
AD: Yeah.

STEWART: ... since the 1950s. So, it's, you could argue that this organization had its roots in a group that was ahead of its time in that sense. And I think that's true.

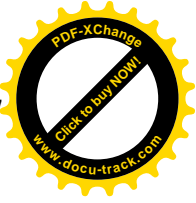
AD: Now, just as oil sands have become such a huge economic force now and, and coal really sank without a trace. We had excellent coal gasification and liquefaction programs and the people who wrote for me for *The Canadian Encyclopaedia*, one particular fellow was from the UK, I think, had worked in Wales in coal research, was distraught when that program ended here and he was facing returning to the UK, which he didn't want to do. So coal ceased to be an economic driver, but of course there is renewed interest in coal, and so, you know, could this facility then return to coal-based research in the future?

STEWART: The skills are transferrable. The laboratory-scale equipment is probably transferrable. And part of the challenge in running a research activity is to make sure that you don't go down blind holes that close off on you. So you really need to understand the flexibility of your skill set and your equipment set. And so, yeah, at some point in time, if that became an issue, I guess my question is, is it Canada's issue, because in terms of the world coal supply we're pretty small. The people that are going to be burning coal like gangbusters, and they already are, the Chinese. The US burns a tremendous amount to make electricity. So argument to me there's about whether we need to be all that upfront about coal at this point in time, or whether we're better off dealing with some of our more unique national treasures. And that's just a, you know, euphemism for oil sands.

AD: Yeah. Yeah. I think it was in yesterday's paper, last couple of days anyway, that you know, the demand for electric cars is peaking, but now, of course, studies are being done on their impact on



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the grid. And when you then look at the eastern US and, in terms of their coal-fired power plants, they're among the oldest and the worst polluters. So, you know, what are the trade-offs? You demonize the use of gasoline and gas guzzling ...

STEWART: Yeah.

AD: ... cars and etc., whatever the source, whether it's conventional oil or synthetic crude, and that somehow electricity's perceived to be cleaner ...

STEWART: Okay.

AD: ... but, you know, think of the devastation of any water-based generation of electricity and then ...

STEWART: Okay.

AD: ... coal-based.

STEWART: Well, let's start with the big question. The big question is "how do you make the comparison?" And what I said before and I'll say again is you've got to do it on a full life-cycle basis, okay; so if you're going to run electric cars, I want to know where you're getting your electricity from? If you're going to run a fuel cell car on hydrogen, I want to know where you're getting your hydrogen from.

AD: Yeah.

STEWART: So you've got to go through that full analysis. You also have to understand that there may well be horrendously energy-intensive materials that are embedded in that technology that you want to use. And, if that's the case, then you've got to understand them as well. And I'll give you an example. If you want to build a big windmill, the first thing you've got to do is pour a big concrete pad. Where do you get your concrete? The answer is you make cement. What are you burning to make the cement? So you go through all that stuff. Then you've got all these composite materials that may or may not require huge amounts of energy inputs to make, but you've got to add those in. So then you do that whole analysis and then you figure out how much energy you get out of that windmill, and then you tell me whether that windmill replicates itself in an energy sense and how many years it takes. And, at that point, you've now got enough information to understand what I mean when I say life-cycle analysis. That's how you have to look at these things.

AD: But you see, that way of viewing any resource that we exploit to enhance our quality of life, it isn't being done, and certainly it's not being talked about in the media.

STEWART: It's not being talked about in the general press. There are people who spend a lot of time and effort trying to do this because it's important. It's a difficult discussion to have with people



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unless you can come up with a simple example that you can use, and that's the reason I sort of worked my way through the windmill one.

AD: Yeah.

STEWART: It's a lot more difficult if you try to talk to somebody about a gasoline-powered car, you know, with all the light alloys we're putting in now, how did you make those? I mean, I've got a new car that's got an aluminum hood. We just had a hail storm. I'm getting a new hood, right; dents all over this thing. Anyway, that's an aside. I won't even tell you what manufacturer it is, although if you know anything about cars you can probably figure it out.

If you go through that discussion, you lose people very quickly, so we have to have a little more simple way of trying to explain it. The people who are doing the local marketing of produce for example, the 100-mile diet and this kind of stuff, it's that kind of a statement level that you can actually use as a popular sort of slogan, and it works.

AD: Yeah.

STEWART: People don't necessarily even understand everything that's embedded in the 100-mile diet, but they understand that it should be a good thing. And so we have to have some way of trying to translate what I'm talking about --a fairly convoluted life-cycle analysis -- into that kind of a slogan.

AD: Well, and then you, when you apply that to the oil sands environmental issues that hasn't come through; they're still looking at the economic ...

STEWART: Yeah.

AD: ... benefit analysis ...

STEWART: Yeah.

AD: ... and showing scientists in lab coats ...

STEWART: Yeah.

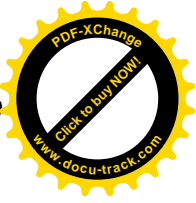
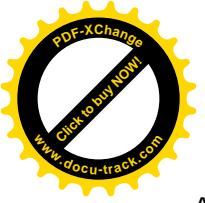
AD: ... with seedlings or whatever.

STEWART: But people can show you the CO<sub>2</sub> burden to produce a barrel of synthetic crude oil. I mean, all the companies can do that and that's the same thing; they call it life-cycle analysis or you call it cradle-to-grave or whatever you want to call it; it's an attempt to try to capture all those related things that happen in the cycle.



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AD: Now just some kind of summative over-arching questions. In terms of your involvement with this facility, what would you count as the successes and just -- name them ...

STEWART: Okay.

AD: ... and describe them.

STEWART: I think the biggest success of this facility would be the flexibility that we were able to demonstrate when we moved away from coal and into oil sands and then moved away from dominated by public-sector funding to a partnership model. Those are a whole bunch of transitions and they happened at difficult times. They happened at times when budgets were going up and down, and program review was happening and other things are going on as well in the funding systems.

It also happened at a time when public-sector interest ebbed and flowed and when private-sector capabilities ebbed and flowed because, understand how it works in a private-sector company when the commodity that you're producing drops in value; you stop doing a lot of things, okay; and one of the things you stop doing is research. And in particular you stop paying the federal government to do research for you. So there's that kind of a thing going on as well. But, strategically, I think that the real message of this facility is it's flexible; it's nimble; it's adaptive; and it can help.

Part of the reason I think we are as successful as we are is that we're not in Ottawa. Federal government is a big organization. The closer you are to headquarters, the more strings there seem to be. So we had a little more flexibility. Sometimes things we did were under the radar and sometimes things that we did were perhaps easier to do here because we weren't in the bright lights of the headquarters environment. So we could try a few things. So that's the general statement, okay.

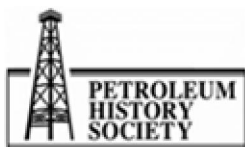
In terms of the specifics, when we made the transition to oil sands, in my mind I said we'll be successful when we have industry lined up here to pilot things that they want to take to the field. And so Shell coming here with Muskeg River, the froth flotation activities, some of the end cut upgrading experiments that were run for companies as long-term pilot projects in the high head area. Those are the things that really made my day because it meant that we were closing what was seen as this gap where there's lots of technology, it sits on the shelf and who gets anywhere with that? So the fact that we made that transition, that's to me -- that was success.

AD: And that you've been a part of that growth, the new companies, the new process ...

STEWART: But that's all part of them filling in to pilot things ...

AD: ... yeah.

STEWART: ... you see.



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AD: Yeah.

STEWART: So ...

AD: Yeah. So what ...

STEWART: Because, remember, if you go back to 1990 and you've talked to Dee Parkinson, I'm ...

AD: Yeah ...

STEWART: ... I'm sure ...

AD: ... yes, yeah.

STEWART: Yeah. There were real questions about whether surface-mined oil sands was going to work.

AD: Yeah.

STEWART: I mean, when she went to Fort McMurray it wasn't necessarily to run an operation. One of the options was to wind it up. And it, things were a little bleaker then. It was a little tough. And I don't think anybody's talking about winding up now.

AD: No.

STEWART: So.

AD: So, you know, this research facility has been a part of that ...

STEWART: We think ...

AD: ... success.

STEWART: ... we think we are part of the collective success. But, as I said before, success has many parents. Okay, everybody wants to claim success. We also had things that didn't quite work out the way you would hope, but that's life and if ...

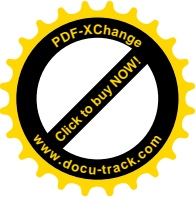
AD: Well, that's my next question. You know, what things did you try that didn't work out?

STEWART: The whole coal thing. I mean this facility was built at great expense, opened in 1984 with people arriving 1985. By 1992, we essentially had turned our back on the coal industry.

AD: Well, you had to.



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STEWART: Had to. But there was a public-policy driver that created this as a coal research facility in the early 1980s. What was there in that decision-making process that within a decade was totally wrong? Is it just inevitable the way things worked, because I said before, I mean the 1970s there was the Club of Rome dialogue; there was all these price shocks; there's great concern about where is the energy going to come from for the next 25 years? And a lot of very bright people said, "eah, we've really got to make the coal option successful. And so this was part of that plan. And it just turned out to be wrong.

AD: Now, in terms of research projects to do with oil sands, can you talk -- were there any that didn't bear fruit?

STEWART: Hm. Well, yeah, I'm sure there are. You try things. Sometimes they work, sometimes they don't. We had a researcher in Ottawa named Martin Turnin who thought he had a way to incorporate methane directly into bitumen -- called methyl-cracking. And it was the result of a very small experiment that was done and, if that was the case, what a tremendous opportunity. Now it could've defied the understanding of the physics and the chemistry, so it was a long shot. So you try one more step. It didn't work. Fine. You understand it didn't work; you stop it. But the potential prize is so big that you've got to try this high-risk, high-reward stuff. But you can't drive your whole program there. Okay? So what you really do, I think, when you're looking at research organizations and you're looking at managers of research organizations, you don't ask questions about ongoing projects because it's always a little difficult to know where they are in that continuum of start to finish. You ask research managers and directors "what did you start; what did you stop; and why?" I think those are much more sensible questions because those are actual, conscious decisions. And it is interesting when you ask those questions how many dumb looks you get. It's not easy.

AD: You're actually alluding to, you know, the skills and gifts that a research manager and director has to have ...

STEWART: Yeah.

AD: ... because, you know ...

STEWART: Yeah.

AD: ... what do you, what do you back, I mean in ...

STEWART: Yeah.

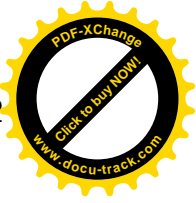
AD: ... terms of allocation of ...

STEWART: Yeah.

AD: ... of resources, whether human ...



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STEWART: Yeah.

AD: ... or ...

STEWART: It's ...

AD: ... or fiscal resources.

STEWART: You need to have a lot of funny skills. You have to be able to herd cats. You have to have a very thick skin. You have to know that your staff are as smart or smarter than you. You have to also appreciate that your staff don't have a lot of allegiance to the organization; their allegiance is to science. Their allegiance and interests are in what do their peers think of their science? They're more interested in going to a conference, not because it's a boondoggle, but because it's an opportunity for them to rub shoulders and bounce ideas back and forth with people who have committed their lives to the same kind of pursuit that they're in. And if you don't understand those drivers, I don't think you can manage a research organization very successfully.

AD: Well, you can't just be a bean counter, can you?

STEWART: No. No, because we're not in the bean business.

AD: If -- you have to have a vision.

STEWART: We're in the brain business.

AD: Yeah.

STEWART: And the next challenge is to figure out how to keep your staff, particularly the good ones, because there are -- is a lot of poaching going on in research organizations. That's life, okay, you understand that. So you've got to understand enough about what drives them ...

AD: Yeah.

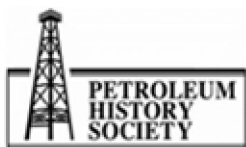
STEWART: ... Okay, one of the reasons they came here was that they don't have this million dollar a year need.

AD: Right.

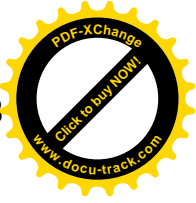
STEWART: They came here with a reasonable financial expectation in exchange for the ability to do stuff that's truly important to them.

AD: Well, you know, in terms of other ...

STEWART: So you better set up the facility's culture that makes that work.



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AD: Yeah.

STEWART: And then you're the mother hen; you jealously guard that.

AD: Yeah.

STEWART: Don't let anybody upset it. You also have to have a few crackpots and there's a whole bunch of ways of describing that and most of them are fairly obscene. But you need to have some sparking and friction going on in the place.

AD: Okay.

STEWART: Beause that's what you need to see -- you don't want too much of it.

AD: Yeah.

STEWART: You can't let it just dominate activities, but that's where some really interesting interfaces and ideas come from. And I can remember talking to an old research manager from France many years ago who said we put a cafeteria in our place and we give everybody a free lunch, and we do that because we get more ideas coming out of the lunchroom than we do out of the research labs.

AD: That unstructured time.

STEWART: Unstructured time that just, and ...

AD: Yeah.

STEWART: ... bouncing around of ideas.

AD: Yeah.

STEWART: So.

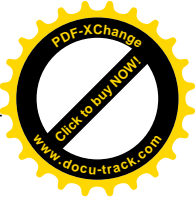
AD: Well, this whole issue of how you choose the talent. I interviewed Fred Otto, who you know, and I said, in terms of your era as Department Chair and Dean and so on, I mean there were some extraordinary people. I said you had a gift for picking talent. Well, of course he was, was very modest about that, but of course you are competing and ... and you know, he mentions Jacob Masliyah, hiring Jacob Masliyah and ... John Shaw and others -- that you want these brains, I mean you know, to go back ... but then, you know, bring their graduate students and that ...

STEWART: Yeah.

AD: ... that this has happened here, and then how do you keep them?



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STEWART: Yeah.

AD: I mean, these people have stayed there.

STEWART: Yeah.

AD: Yes, they've done work with other entities but they've stayed there. Now in terms of any -- what would you consider superstars that you had and you nurtured in this facility in the time that you were here?

STEWART: I'm not going to go there I don't think.

AD: Okay, that's all right.

STEWART: And the reason I'm not is the following: in your educational background, if you're not in engineering, most of what you do is by yourself and as you go through grad school you're told that you're special and you're doing something truly unique, because if it's not unique you don't get your PhD, or whatever. The reality in the work we do here is it's teams; it's multidisciplinary teams. Everybody's got to bring their piece to the puzzle. Nobody had all the ideas.

AD: Okay.

STEWART: And in order for us to succeed, particularly to get things to pilot scale, we've got to have really strong fundamental scientists who can work with more-applied engineering people; we've got to have technologist who really know how to make things happen at bigger than bucket scale.

AD: Okay.

STEWART: All those pieces have to fit together. And so I don't think it's fair to pick one over the others because you need them all. And we always have had a lot of students here and many of those students never came back, but they left this place having spent one work term here knowing something about the science culture of how we work at least, and hopefully have dragged parts of that on with them. But that also means that your technical support staff are to some extent student supervisors, okay, so that's a different issue. And so you're looking for a whole different kind of different sets of skills and it really is a function of what you're doing. So in our case it was small multidisciplinary teams.

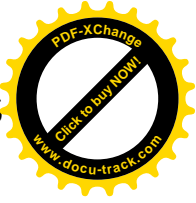
AD: And so how would you describe the culture of this facility under your leadership?

STEWART: I would say that it's a bunch of hard-headed dominant personalities who learned how to tolerate each other. Okay. They learned how to do that because they saw the successes of some of these multidisciplinary projects coming through and they saw the writing on the wall. I mean one of the things about researchers is they understand the rules pretty well once you tell them what the rules are, and our rule was clearly becoming -- "We need partnership models. We need to



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demonstrate the things that we're doing here and making it to the field." If you don't do that, you're not part of the group. And so that transition happened here. It's both a blessing and a curse that a lot of the people that came here to work are still here. It's a blessing because you've got people long tenured in jobs who have grown in the organization, who have a lot invested in the organization, and can bring a lot to the table. Downside is, if they've never worked anywhere else, they've got all the squabbles that you'd expect to see from people who don't know how bad it could be. Okay.

AD: Elsewhere.

STEWART: Elsewhere, so ...

AD: Yeah.

STEWART: ... that's the balance point there.

AD: Yeah.

STEWART: So the culture here is a tremendous amount of individual flexibility and freedom to do things within a strategic plan that is clear, and people can see how their job relates to it. And that's, I think, important in any sort of brain-based organization. You've got to give people their head a little bit. But you can't just let them wander around in the dark. Now, I don't know how it's going now, it's been nine years since I was here. I will tell you that when people come up to me and say "gee, we wish you'd come back; we remember the good old days; everybody remembers the good old days."

AD: Good old days.

STEWART: You forget the bad stuff that happened in the bad old days.

AD: Yeah.

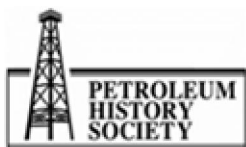
STEWART: But you remember the good stuff that you can remember and associate with. So I don't think it's a fair comparison. I have no idea ...

AD: Okay.

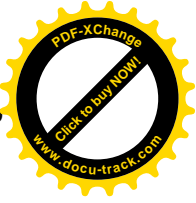
STEWART: ... how they're doing here now. I enjoy the place; I enjoy meeting people that worked here, but I've really tried to keep my nose out because I thought it was fundamentally unfair to come in here and tell people how to do their things.

AD: Now, you mentioned the internships and so on, so that it was really a training ground as well, this facility.

STEWART: Yeah, and that's part, I think, of the public good argument ...



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AD: Yeah.

STEWART: ... that one of the things that you're doing is trying to nurture and train people. And we may end up with somebody who comes wandering in here at some point in time with a technology for oil sands that he incubated in a totally-different industrial sector, but he remembered about the oil sands experience because he had it here as a student, and he might bring it back in. You have no idea of knowing that that's going to happen or not. But it might.

AD: And so, you know, how many of your staff in that period then went to work for industry or university research establishments? Was there much mobil[ity] -- you know, did people move in and out very much?

STEWART: Yeah. I can't give you a number, but people move on. Young people who are, who come in here to work in the pilot area in particular are all of a sudden very attractive candidates to move to Fort McMurray.

AD: Okay. So, so ...

STEWART: Okay, so you end up with those ...

AD: ... but that's a surface function, isn't it, though, that you're ...

STEWART: Yeah, well ...

AD: ... training these people.

STEWART: ... depends on your perspective, okay; if you're in the public good business ...

AD: Yeah.

STEWART: ... you're saying you're creating the skills that these guys need to migrate the technology to the field.

AD: Okay.

STEWART: Okay? If you look at it more as a parochial "how's this facility working," they're poachers. Okay? But that's life, I mean you put up with that and go on.

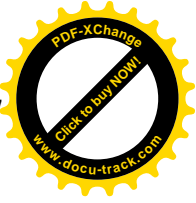
AD: Now, is there any question that I haven't asked you or that, you know, any issue that you'd like to address?

STEWART: We've talked around it in a whole bunch of different ways, never come dead on about what I see as a problem in the way the public-sector funds work.

AD: Okay.



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STEWART: And it has to do with everybody wants to fund individual, specified-duration projects, and that's a nice way to operate if you're a funder because you know what you're going to get. And then you can put in a competitive system that forces people to write proposals and then you can pick the best proposals and yada, yada yada, away you go. The problem is if you're in that model, you are counting on somebody else paying the patient money to develop the skills that you're now going to use. And I want to know who's doing that because somebody has to. And if somebody doesn't do that, you're eating your seed corn; you're picking all the cherries off the tree; and nobody is planting and nobody's growing trees. And that to me is one of the weaknesses in the way the current funding models are looking. I don't believe that it's reasonable for the public sector just to go out and pick on existing expertise. I think the public sector has to play a role in growing expertise.

AD: Well, you see, that's not just an issue with research establishments; like I was in the non-profit field for many, many years and the project-based funding where you can't -- how do you cover your core administrative and facilities costs ...

STEWART: Yeah.

AD: ... if everything ...

STEWART: Yeah.

AD: ... is project-based? And project-based funding, as you say, doesn't deal with the root of and creation of organizations that have a culture of continuous research development ...

STEWART: Yeah.

AD: ... innovation, you know, all ...

STEWART: Yeah.

AD: ... all of those things.

STEWART: That's the one element of it. The second one is critical mass.

AD: Yeah.

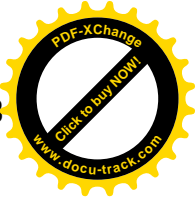
STEWART: The reality is you've got to be able to move, and move fast when you got to go.

AD: Yeah.

STEWART: And that means you have to be deep enough to be able to have some pace to what you're doing.



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AD: Yeah.

STEWART: And you don't develop depth to create pace in a project-based funding model.

AD: Yeah.

STEWART: And, as a country, Canada is too small to have all those things in all fields, so we've got to make choices. And I know that's tough, but you've got to make choices. When we decided to go into oil sands, there were a whole bunch of other fields we could've looked at to exploit the skill set that we had. But we decided that if we were to allow those other opportunities to get in the way, we wouldn't have the pace or the mass in terms of size, to make the difference that the oil sands industry needed to see the resurgence that we now see in surface-mined oil sands.

AD: Who made that decision? I mean ...

STEWART: We did; in this building.

AD: And so ...

STEWART: David Brown ...

AD: Yeah.

STEWART: ... myself and Hassan Hamza.

AD: Okay, so that you then gave the shape to the facility that we see ...

STEWART: Yes.

AD: ... we see today.

STEWART: Yeah.

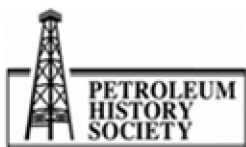
AD: And what made you see oil sands? At that point they were hurting, and as you said, there were the two, the two miners -- what made you see this as a need area and a growth area, in terms of research?

STEWART: It was ... it was the strategic value we saw to the opportunity.

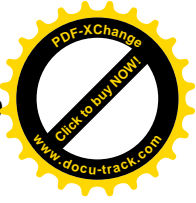
AD: Okay.

STEWART: It was the skills that we had; it was the location we were in.

AD: Okay.



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STEWART: And the fact that we didn't see anybody else in this area that was going to contribute to a resolution on these issues.

AD: So, in other words, you described AOSTRA as a funder; I mean you had the research establishment at the U of A; you had an emerging research establishment oil sands related at the U of C, but you felt that you had special knowledge and skills.

STEWART: Knowledge, skills, equipment, the pilot-scale capability, all the things that we thought we would need and, then, when you do the external scan you look out; we thought this is -- if we don't do it, it's not going to happen.

AD: Okay.

STEWART: And it's too big a prize not to do it. And it's too good a fit not to do it.

AD: Yeah.

STEWART: So let's do it.

AD: Yeah. Now, you've mentioned Shell as one of the companies that you worked with. Do you want to name some of the others?

STEWART: Every one of them that's in the oil sands we've worked with.

AD: Absolutely.

STEWART: Every one of them. I don't think you can find anybody who's even close to it that we haven't worked with.

AD: Okay, and so that piloting capacity has been instrumental in ...

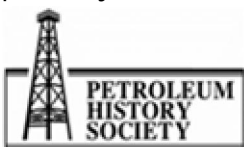
STEWART: It, it, piloting --Shell, okay.

AD: Yeah.

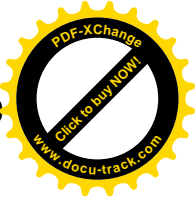
STEWART: I don't know how many others have come to do pilots here after I left, I have no idea.

AD: Yeah, yeah.

STEWART: But I do know that we've done a lot of research work for others in terms of helping them understand the specifics of how their process is going to work, given our understanding of either bitumen chemistry, in surface and interfacial science, hydrocarbon conversion chemistry, whatever it is that we have a skill set in. We bring that to bear on potential problems that we can help industry solve. So if you're in oil sands you should know the name of this place because you've probably been here.



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AD: Okay.

STEWART: More than once. Mechanisms like Conrad were a great help in that regard, as I'm sure the new one will as well because we had people who got together to do pre-competitive research together. And they were not necessarily at the start all that keen about it because it was really something they hadn't done much of before. But they learned you can get along. When it comes to dollars and push comes to shove, it's a little different because everybody's got an individual corporate perspective.

AD: Yeah.

STEWART: Okay.

AD: But you've used the term pre-competitive ...

STEWART: Yeah.

AD: ... research, and which is key because these companies have ingrained in them that they are competitors.

STEWART: But they also learned by working here in pre-competitive work that people here are trustworthy.

AD: Okay.

STEWART: And you can come back here one on one and do confidential work and we won't spill the beans to anybody.

AD: Okay.

STEWART: Okay? So you end up with a continuity but you also provide these new entrants with a pathway to making their resource into a reserve into an operation. And if we weren't here to do that, it's pretty hard to go somewhere else and find a pilot plant for oil sands.

AD: Well, I think you've given me an insight into the uniqueness of the place and ...

STEWART: Yeah.

AD: ... and the achievements. Is there anything else that you'd like to put on the record, as it were?

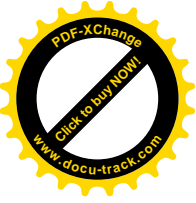
STEWART: I think I pretty much hit most of the bases that I thought I should today.

AD: Good.



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STEWART: The little bit about humanities and social sciences funding -- don't want to make too big a deal about it, but I really don't think it's good use of senior researcher's time to write endless proposals for peanuts.

AD: Yeah.

STEWART: It really is a bad idea. Okay? And what's even worse is the delay between writing the proposal and getting acceptance and the flow of the money. I don't know how you manage grad students on that basis.

AD: No.

STEWART: It's just a zoo.

AD: It's a (?).

STEWART: There has to be a different way.

AD: Yeah.

STEWART: And we really should look at what those different ways could be.

AD: Good. Well, thank you so much for agreeing to be interviewed.

STEWART: Oh, you're welcome. If you want to do a follow-up, we can do that too.

AD: Thanks so much. Good. Yeah, I think we covered a lot of ...

[THE INTERVIEW CONCLUDES.]

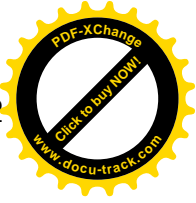
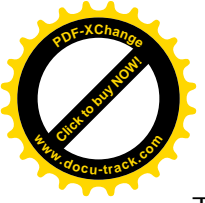
Email from Bruce Stewart to Adriana Davies, September 22, 2013

Hello Adriana

I have had a look at the transcript and while there are some small typos and transcription errors they are not worth correcting. In retrospect, the one area that we could have spent more time on is the future world energy supply and demand projections in the 20 to 150 year timeframe. It is in that context that oil sands will be a bridge to a much more diversified energy future. One other way of expressing that is to ask the question "How will Alberta and Canada do in exploiting the oil sands prize before alternatives and new technologies result in the world's energy-supply demand moving on to a different type of energy?" At that point, oil sands and other hydrocarbons may run the risk of becoming stranded resources that lack value sufficient to warrant exploitation.



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The other point that I would make in a repeat interview is that oil sands samples if sent to any analytical soils lab for analysis (the labs that look at soil samples from fuel stations that may have had leaky underground storage tanks) would ring every bell and whistle and come back as a dangerously hydrocarbon contaminated soil sample. Such hazardous soils cost thousands of dollars per ton to remediate while surface mined oil sand operators do the job for tens of dollars per ton and make a profit in the process.

That's all for now other than to wonder how the interviews with Hassan Hamza and David Brown went.

Bruce



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