Atlantic Institute for AIMS Market Studies

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CANADIAN ASSOCIATION OF PETROLEUM PRODUCERS

Present

Dr. G. Campbell Watkins

Are We Running Out of Oil?

May 27, 2004

Halifax Club

BRIAN CROWLEY

All right, ladies and gentlemen, let me call this breakfast meeting to order and get things under way.

Campbell Watkins will be known to many of you. Probably he is best known here in Nova Scotia and in Atlantic Canada for a paper that he wrote for the Institute a couple of years ago called *Atlantic Petroleum Royalties: A Fair Deal or Raw Deal?*. We understand that it became Premier Hamm's favourite reading. It has been the subject of quite a lot of discussion in the legislature. So we like to think that that is his largest claim to fame, but of course Campbell has many other claims to fame.

Campbell Watkins (left) and AIMS' author Roland Martin speak before Dr. Watkins' presentation.

Before I get to them, since we are talking about AIMS' papers, I just wanted to acknowledge Rollie Martin, who is here, because those of you who may have looked at the front of the *Globe* this morning will have noticed that Stephen Harper was in St. John's yesterday announcing that his party has formally adopted the equalization reform that Rollie helped to popularize with a paper for the Institute three years ago now, and that we have subsequently been working very hard to promote. I am quite convinced that reform will be adopted by the government of Canada, probably within the next ten years. So congratulations, Rollie. Just so that you all know that it's not so improbable that AIMS claims that we have some influence.

But to come back to Campbell — Campbell says the most important thing about him is that he's a long-time resident of Flamesville, otherwise known as Calgary, but now he's living just outside Victoria. He is a professor of economics at the University of Aberdeen, and an honorary professor at the University of Aberdeen. He is joint editor of the *Energy Journal*. He is consultant to the BC government on fiscal regime that they are putting together for the offshore, and he is here with his colleague from BC working on exactly those issues. And I was just out in BC talking to the Priddle Panel, which is examining the idea of the offshore moratorium, talking about the east coast offshore experience there.

In 2002 he held the Saudi Aramco Chair in energy economics, I believe it is, at King Faud University in Saudi Arabia, where he spent six months. I get fabulous e-mails from Campbell talking about his travels. He's not only a brilliant energy economist, but he's also a very acute observer. I may distribute to some of you sometime some of the commentaries he has written on the places he's been.

Campbell is here in town to talk about the east coast experience with the offshore, to bring some of that experience back to British Columbia. And when we knew he was coming, we thought that since he has such a good relationship with the Institute, he would be delighted to take a few minutes to talk to a few of you here in town about some issues that he thought were important in energy. We gave it a catchy title of "Are We Running Out of Oil?". Campbell said, "That's not what I called it". Campbell is always very careful with the way he phrases things. And so I think he's going to talk about changes in world oil reserves and so on, but the subject is all about whether or not we are running out oil.

So, Campbell, could I turn things over to you then.

CAMPBELL WATKINS

Good morning, I am very happy to be here. Brian was out in Victoria about two weeks ago and gave an impassioned address to what they call the Priddle Commission and I think it's no coincidence that they've actually closed that Commission down, because after Brian had spoken there was really nothing more to be said.

Now he's given me this title, "Are We Running Out of Oil?", in which case if we really stick to that title this is going to be a very short address indeed, because I'd say no, and not only no, but the question isn't really meaningful.

Dr. G. Campbell Watkins

Let me give you a bit on the origin of what I'm going to be talking about. There is a journal called *Energy Policy*. They had a 30-year anniversary in March and they had an editorial board meeting. They put it into a kind of mini-conference and what I was asked to talk about was oil scarcity, what have we learned over the past 30 years. So that's really the basis of my paper. What I'm going to be doing is more a framework paper. I'm not going to be telling you - I wouldn't even pretend to know - whether world oil production is going to peak in the year 2010 or 2015 or 2020. There is lots of that sort of stuff going around. In fact, I found that when I was doing the paper for the March meeting, I didn't realize it, but there's an association for the study of peak oil, ASPO. It's based in Paris and deals with a series of papers all predicting when world oil production is going to peak. I'm not going to be entering into that field of prediction. As I said, I don't think it's a particularly useful exercise.

I'm going to put up a slide that outlines the way I want to organize this talk. So I'm not going to read what you can read perfectly well, but let me make some comments on the first issue there: "Oil as an Economic Commodity".

Oil entered the economic system because it was an economic form of energy, and it will go out of the system when there are other suitable substitutes, or if it becomes too expensive, or both.

You may recall back in the past that it was thought that the oil industry was somehow unique — it was a very different industry, and you couldn't apply normal economic analysis to it. That is not the case. As with almost all other industries, you can increase supply by new investment. What is interesting with respect to oil is you can't, in fact, predict what that new investment will generate — there is a great deal of uncertainty.

But it is an economic commodity and it's not a freak industry. It's an industry that performs in the way other industries perform. There is nothing unusual about it in that sense.

What has been happening is that there are two opposing forces. One is:, yes, indeed, if you deplete current reservoirs, then supply is curtailed. On the other hand, we have new investment increasing supply and we also have new knowledge and technology and, in the case of, for example, the offshore industry both here and elsewhere in the world, that has proved to be a very powerful influence on the ability of the oil industry to enter new areas and new depths and go into regions that were not thought to be economic at all years ago.

I think, as I suggest right at the bottom there, there's been this kind of standoff between the depletion aspects of the oil industry and the increasing knowledge, including technological knowledge.

So when I was asked to look at what's happened over 30 years, what have we come to know over 30 years, I went back and looked at some of the opinions quite prevalent at that time.

Let me quote one. US President Jimmy Carter proclaimed in 1977 that we could use up all the proven reserves in the entire world by the end of the next decade. That is certainly an extreme example, but at the same time there are a lot of other opinions of that nature. And, in fact, it was the prevalent opinion.

It's not gone away, as you will probably have noticed from reading newspapers. Let me quote one particularly apocalyptic opinion by somebody in Paris, Deffase, who said in 2002, "Somewhere between two and six years from now, world-wide production will peak and after that chronic shortages will be a way of life".

So one of the first questions I asked myself was, well, let's just look at what's happened to aggregate world supply over the 30-year period, 1973 to 2002. That table is a bit difficult for you to read, but let me highlight some of the main numbers. First of all, look at what's happened to world oil reserves. These are in billions of barrels. World reserves increased by about 500 billion, 2002 over 1973, and these are remaining reserves. OPEC's share of world oil reserves remains actually remarkably constant. What is interesting is that OPEC in 1973 accounted for about 60 percent of world output. In 2002 it was accounting for something like 40 percent.

So, far from the expectations in the 1970s, among so many, that the world would be in thrall to OPEC, increasingly the opposite has happened.

The world reserves production ratio, a ratio of remaining reserves to production, increased, not decreased, in that period. And the world oil price, yes, has gone up by about five times in nominal dollars, and in real dollars it's about doubled. That's from, I think, early 1973 and it's before the quite substantial price rise in 1974.

Now the reserve production ratios are quite interesting. The non-OPEC reserves production ratio — and there's been a huge expansion of non-OPEC output — what I call the

"mature" reserves production ratio, is 14 years. But OPEC had a huge reserves production ratio of 80 years in 2002. And that, in effect, really tells you why OPEC is there and why it controls or needs to control output.

In attendance, (left to right): AIMS Chairman David McD. Mann, Roland Martin and Secunda Marine's Fred Smithers

What about the strong performance of non-OPEC production? Well, that is almost a kind of classical response to the umbrella of high prices that has been sustained by OPEC.

So that's the evidence I looked at just in terms of broad aggregate supply. The world has unfolded almost in precisely the opposite way from the predictions of the 70s and early 80s, that I call this thing "confounding Cassandra". That's what it is.

Now the next bit of evidence I wanted to look at was economic indicators of scarcity. As you would imagine, price and cost trends are the important elements here, and I'm going to show you in a moment the estimates that I've done with Morris Adelman. What we tried to do is estimate a price series for prices of reserves in the ground, not wellhead prices. This is how much people are paying to buy reserves *in situ*, in the ground. It's a better indicator of issues relating to scarcity because, as you will know from reading the newspapers, prices fluctuate all over the map on a daily basis, that's the price of flowing oil at the well head. What we tried to estimate, as best we could, was what's been happening to the market price of reserves in the ground.

A period of estimation, you see there is 1982 to 2002. How did we do this? Well, we had a quite rich source of data compiled by a company in the United States on reserve transactions. You have to then adjust some of those data because what you want to do is try and get at the price of oil

in the ground and not confuse it with deals that are done to buy other assets — downstream pipelines and all that sort of stuff. You have to clean up the data. For most years, we had an excess of about 100 observations, and then we estimated what the price of oil in the ground was for those transactions, and the price of natural gas in the ground.

I should also add that you may think, well, all right, we used the US data, isn't that too parochial when you're looking at the world scene? Well, not really, because from 1982 on with deregulation in the United States it was an open market and a lot of the companies involved in purchasing and selling oil and gas reserves in the United States are those who are operating in the international market as well. So, in fact, I would argue, and I think it's perfectly valid, that the US data do provide you with a window on the world oil industry as well.

So let me put up the results of that analysis. Now, these are nominal dollars, and I think it's pretty easy for you to -- I mean, Liz Parr-Johnston would probably like me to do some fancy statistical analysis with this stuff and do trend fitting and goodness knows what. But I looked at it and I don't think you really need to do that. There's no apparent upward trend over this 20-year period. Most recently, yes, there has been an upward trend, but remember these are nominal prices and if you correct this to real terms you're actually below the mid-1980s' reserve prices right now.

So again, over this period that I'm talking about, the last 30 years, there is no evidence of looming oil scarcity in terms of reserve prices. And I regard that as quite an important finding. If you believed the people back in 1970, we'd be seeing prices up here if it was really a question of emerging scarcity.

So the next question I posed was: why is it that we have all these Cassandra-type prophecies? They are still coming out, almost daily, in North America — different circumstances

this time, and it's an admission that, yes, indeed, we've been wrong but, no, this time for sure the wolf is here and it's just outside the door.

The foundation for a lot of this work is a paper done by a US geologist, King Hubbard, in, I think, 1956, which correctly predicted when US oil production was going to peak. He used what's called a logistic model and we'll have a look at it in a moment. It's a symmetrical bell profile. You have a growth and then you peak and that's why we have this association trying to discover when oil is going to peak and go down.

So that's the Hubbard curve. And you can see that if you employ this kind of analysis — and then you aggregate it with different regions and goodness knows what — you get onto this part of the curve and there's no comeback. It becomes increasingly severe. Now, if you look at the US, it was, I think, around about 1973 that King Hubbard predicted the US peak. What happened afterwards is not like this. It gets skewed off to the right. So it's not a symmetrical thing at all. So then you ask yourself, well, what is wrong with this whole notion? And to my mind, the easiest way of saying what's wrong with it is you've got a classic case of omitted variables. There is nothing there to look at the impact of price and the impact of technology, probably the two big factors. They're not in there at all, and so when you look at a lot of the papers that have emerged and are emerging using this kind of approach, they do not talk about those factors or don't express them in any way in the analysis.

Also with this approach —, I've labelled it "ultimate cumulative production" — you get another arm of the Hubbard approach with the notion that there is some kind of fixed stock out there and that's ultimate production. In dictionary terms, that's the final total oil production that is feasible and will happen.

It's rather unfortunate, I think, in my view, because this whole notion that there is just a fixed stock — and then finally you take the last barrel out of the ground and that's it — is completely erroneous. That is not the problem that we're confronted with.

I want to just read you a quote, and I've used it many times, by Morris Adelman, and I think he puts it very well. Let me read this to you. "The total mineral in the earth is an irrelevant, non-binding constraint. If expected finding and development costs exceed the expected net revenues, investment dries up and the industry disappears". That's relating to my earlier comments about oil as an economic commodity. "Whatever is left in the ground is unknown, probably unknowable, but surely unimportant, a geological fact of no economic interest".

Brent Austin from Encana poses a question to Dr. Watkins

So what's another way of looking at this issue, which, to my mind, makes more sense? Well, you go back to your basic economic textbook, the supply curve, and you have it up there. Yes, I'll do that, and then I'll show the curve in a moment. The notion of the supply curve is that, of course, you can stack your supply commodity in order of ascending costs and then you build up the supply curve. And with oil, again, there's nothing peculiar about that. You think about reserves, say, in Alberta, and some of the fields are prolific, Bonnie Glen for example, and some of them are less prolific and are much higher cost, for example Pembina, so you can stack up your reserves by field as a supply curve.

When you're depleting your oil reserves, while the supply curve moves to the left, new discoveries, new technology can shove it to the right. The key thing when you're looking at the outlook for world oil supply is whether this supply curve is shifting and, if so, in what direction.

In terms of doing analysis like this, admittedly the data for a long period are not very good. And so any analysis that is done, and I'm going to show an example in a moment, is restricted by the poor quality of a lot of the data. Nevertheless, to my mind, it's a much more fruitful endeavour than trying to do Hubbard-style curve analysis.

I've had a go at this — here's your notional supply curve, and this is in terms of reserve additions. This is the price of reserves per unit and there you have a curve shifting out to the right. New prospects, technological development, and here is the reserves depletion. As I argued, it's what is happening to this curve that is the important thing.

I had a go at this about four or five years ago using data for 41 countries. It's a pretty simple model, because it's dictated by the fact that you don't have very good data. But let me just explain what this is. That's reserves additions, and it's saying this is a function of some constant, plus this variable here, which is really the window on exploration, the difference between the value of a developed reserve in the ground - that's the series I talked to you earlier about, the work Adelman and I have done to estimate that - and from this you deduct development costs. So that window is the exploration margin. And then this variable here, AT, is the important one. It's almost as a confession of ignorance as it uses time as a surrogate for the net effect of depletion, technological change, new exploration, and development.

If the coefficient of that term is negative, it means the supply curve is moving to the left. If it's positive, it means it's moving to the right. So that was the work I was doing — incidentally it's available as a World Bank study — that's what we were trying to get at.

And so what kind of results do we get? Well, we had 26 countries where there were, in fact, significant changes in the supply function, of which about half of them were contracting, that's moving to the left, and the other ones were what I call expansionary, moving to the right. The end result of the analysis was that a gloomy outlook for world oil supply and aggregate was not warranted.

So let me bring together the conclusions of what I've tried to look at over 30 years. There's no indication to date from any of the economic indicators that I've looked at of scarcer supply. We've had this kind of tug-of-war between the depletion impacts and the high cost impacts and the expansionary factors, new technology, new prospects, new areas, and it seems to have been pretty well a saw-off. Does this mean that you can just say, well, don't concern yourself about this issue? It's not something you want to bother yourself about. But if conditions do change, your best indicator of what's going on will be what's happening to reserve prices. If, indeed, we're moving to a higher-cost plateau for oil ,then the data that are collected on reserve prices will provide you your kind of best early warning indicator.

I argue, forget the Hubbard analysis — it's not really useful. The research should be directed toward trying to estimate economic supply functions, and I've gone through one attempt I made. There are others, and I mention them in my paper.

The interesting question is, and this is my final comment, if you look at a $41 or $42 price per barrel of oil now, that's for flowing oil. I would argue that that's like a shortage price without a shortage. It's a contrived shortage. It's a shortage because OPEC has been quite successful in restricting its supply. It is not an indicator, at this stage, of any fundamental oil scarcity. Thanks.

Oh, I should say that if anybody is interested in getting the paper, it's not that long, it's about a 12-page paper, I'll be happy to e-mail it to you as an attachment. So if anybody wants it and gives me an e-mail address, I can do that for you.

BRIAN CROWLEY

All right, ladies and gentlemen, we promised we'd try and have you out by 9:00 and by my watch we've got one minute. [applause]

We have a little gift on behalf of CAPP, our sponsor of this event, the Association of Petroleum Producers and AIMS, which I'd like to give to Campbell on your behalf and we could have a little photo here for posterity. I'm sure that Campbell would be happy to hang around for a minute or two afterwards if you have other questions that you didn't want to put during the formal session, and I'd like to thank you all for attending. We hope to see you at another AIMS event very soon.

Breakfast participants (left to right) : AIMS president Brian Lee Crowley, Dr. G. Campbell Watkins, AIMS board member Dr. Elizabeth Parr-Johnston, AIMS Chairman David McD. Mann and AIMS board member G. Peter Marshall