

Royal Academy of Engineering

Interview with

**Abdallah Jum'ah
Ex-CEO of Saudi Aramco, now retired**

by

**Lord Browne of Madingley,
President of the Royal Academy of Engineering**

Q&A Session

Question & Answer Session

Lord Browne: Thank you very much for that lecture. Now I am sure there are some people who would like to ask questions, and I think you would like to answer them. If you do not have a question, make a statement. All I would ask you to do is to put your hand up, as this gentleman has done, and to identify yourself when a microphone is given to you.

Arthur Burnett (Offshore and Marine International Services): I was very pleased to hear that splendid lecture, but I have a few points to raise. Can you please comment on the influence of the vast gas reserves which exist off north Siberia, off Qatar and the South China Sea, and in Brazil and in various other places, because this is coming forward. I know it has had difficulties in transportation to the market place, but there are vast resources of gas and you have hardly mentioned the fact that this is going to influence energy use tremendously in the coming years, and if you could make some comments about LNG in connection with this, it would be appreciated.

Before I sit down, I would like to mention one other thing. You mentioned about the engineers getting their tunes different onto all sorts of activities instead of the more conventional. The MacRobert Award, which is the biggest engineering prize available to engineering companies, was won this year by Arup Partners, who designed the Cube, which was the bathing pool for the Beijing Olympics. I think that is a good example of changing your action and putting it into a new pot.

Lord Browne: Thank you very much. Abdallah, why not answer that and then we will take them one at a time.

Abdallah Jum'ah: That was a good question for John Browne! I did not mention those but simply what we need, all sources of energy. Even if those resources are in difficult areas, they are going to come, because human ingenuity is limitless. If they do not come in the coming decade, they probably will in a further decade. But I do not know what else I can say, other than every btu that we can lay our hand on, the world is going to chase it. I think beside the issue of just these gas resources, there is a lot of tight gas that is available, in many parts of the world. I think tight gas also needs a lot of technology to bring it and make it economic, and this tight gas is available all over. We have tight gas areas in the Kingdom of Saudi Arabia, and one of the focus areas of my former engineers – now I speak of Aramco in the past – is to look at how we can bring forward technologies to unlock these resources and bring them to the market. That is why I am saying the world is endowed with a lot of resources. The problem is not underground, the problem is above ground.

Jonathan Leake (Science & Environment Editor, *The Sunday Times*): The title of your lecture is “Sustainable Energy”. You seem to have redefined it. In Britain sustainable energy is generally taken to mean low carbon energy, the kind of energy that you get maybe from wind farms. But your definition seems to be – correct me if I am wrong – the ability to find and extract ever more oil and keep supplies sustainable in the sense of always being able to meet demand. I wonder if you could just explain, especially given that this year is the year of Copenhagen, how you think the oil industry and the carbon that it emits might become reconciled with the low carbon

agenda and the need to keep carbon in the atmosphere at, say, 400 parts of a million when it is already 373. You seem to envisage a future of ever-increasing demand, and I imagine ever-increasing emissions.

- A.** I just want to be realistic. Today, when you look at our energy consumption, fossil fuels is it. Fossil fuels are coal, gas and oil. Then you have, what, 7% of nuclear and then you have 7% of alternatives, half of which, as I mentioned, is really biomass. So how do I reconcile it with Copenhagen? I do not know how I reconcile it. What I am trying to say is that fossil fuels are going to be with us for the long haul, and what we need to do, really the role is to green them, to work hard instead of putting huge investment only to bring alternatives fuels, also less direct, huge investments towards greening fossil fuels, and we are doing our part. We are working with a lot of international institutions of learning to try to work on carbon management, carbon capture. In fact, there is a young Saudi woman who is doing her postgraduate right here in the UK on carbon management. We have to handle carbon management, we will have to work on it. It is not to shun oil today. We cannot sustain our life without hydrocarbons in the foreseeable future. So this is the paradox. It is not an “either/or”. We have no choice but to use fossil fuels, but we will have to work hard to green them. In the meantime we have to work on alternatives. But alternatives are not going to be a replacement of fossil fuels. They will be supplementary, given the demand picture that you are seeing.

John Miles (Arup): I am with Arup, the company that did the Water Cube.

- A.** Congratulations.

- Q.** Thank you. You made a very clear case about the potential for reserves to have an enormous life, and I think you made the point that we have consumed a very small amount of known reserves so far. But it seems to me that there is another issue, which is the rate of extraction. With the recent lack of investments in new, large oil finds, and with the potential for demand to go up quite rapidly in future as you pointed out, it seems to me that we must be looking at least in the short term at a fairly serious shortfall, because we will not be able to pump the oil fast enough. I just wondered if you might comment on your expectations of oil price and how long that shortfall might last before it is repaired, notwithstanding the temporary reduction in need at the moment.

- A.** I do not whether that was a question or a statement.

Lord Browne: I would take it as a question.

- A.** I agree with you. We are concerned about the lack of investment. But I can tell you that in Saudi Aramco, for instance, in the last ten years, we did not have to draw down our reserve number, because every year we were able to add to our reserves at least as much as we have produced the previous year. What was giving us that? Additional technologies to give us more knowledge about our fields. The challenge I gave our people is, as I said, that in general the industry extracts 30% of that oil in place. We need to improve that. By the way, Saudi Aramco in the Abqaiq fields have done up to 70%. We have done that. It is doable, but again, we need more technologies to help us unlock those resources, and between conventional and non-conventional – I mentioned the number, around 15 trillion barrels. If the non-conventional, which is around seven trillion barrels, if technology can give us the ability to extract something like 10-15%, that is exactly equivalent to all the oil that the world has consumed from the dawn of the oil age. One trillion barrels we have consumed.

John Lowe (Member, Institution of Mechanical Engineers): My background is Ford Motor Company and heavy industry in the oil production scenario. I am not sure that I agree completely with the scenario that you have projected, and I was indeed going to question also the effect of a continued pattern of development along the historical lines. But that point has been partly mentioned by the second question that you took, and I would characterise your reply by saying that you are talking about the availability of supplies and the ability to make them available for human use. However, I think it is possible that other factors will move in here. I do not necessarily see that population growth will rise to nine billion, since I think there are other pressures on resources that may give us some very nasty shocks in the future.

That brings me to the point I want to make. You spoke about the shortage of engineers and the need for engineers to think beyond the box, not just technical solutions. I totally agree with you there. The work that I currently do is to promote science, technology, engineering and mathematics to young people through various media. I suggest that there is still room to do more on that, not just in the UK but internationally. Whether your scenario is right, that we can return to the supply having a long future, or the alternative, that we are going to be limited by climate, resource limits, war, pestilence, whether the bad scenario applies, we have to educate more engineers and technicians. Would you please comment on how Saudi Aramco – and I know that BP certainly have been playing their role on this – will help us in the world community to step up to that challenge.

A. Saudi Aramco is a big player, of course, but not the only player. I will just focus on people's development in Saudi Aramco. Saudi Aramco is the company that probably is spending most on the development of human resources. I think back in 1983, we were probably spending \$600 million per annum on training and development. What we were trying to do at that time in all our plans and our engineering disciplines in the plans was to "Saudise" them. We were able to Saudise, I mean put Saudis in the oil and gas, in the operator side, and then we have a huge programme to develop engineering talent.

Today we have around – I would say the number is something like 20,000 professionals with college degrees, probably out of 52,000 employees. The bulk of them are engineers. The only one who was not an engineer was the CEO at that time! But today every year we sponsor – we have 15,000 applicants, high school graduates, and we in Saudi Aramco take 300 males and around 100 females. We started a female programme three years ago, although we have been hiring females for many years. But we are now hiring 100 females and 300 males every year and these are the cream of the cream of the product of the Saudi system, and many of them go out of Kingdom. In fact, as I mentioned we already graduated – since September 11, of course, we shifted towards the UK, and we graduated around 100 people, male and female, already from this country, we have around 416. But we also have our students, a huge number, still in the United States, but in Beijing, in Korea, in Japan, they are also going to school and we are graduating people from those areas. These are going to work for Saudi Aramco, but actually they are working for the oil industry – and many of our people, by the way, are now joining the industry, also in Kingdom and out of Kingdom, many of our people, some who got experience with us, and they have gone. So when we look at it from the standpoint of human resource development, I think we are doing a lot in Saudi Aramco to help the industry, to sustain this industry for the future.

Mark Dame (UOP Ltd): My area of expertise is in the downstream refining area. Of course, if you are going to increase exploration you also have to have increased

refining capacity, and until recently, particular in the West, refineries seem to have been put on the back burner. I presume you foresee this situation being reversed. In what areas of the world do you expect new refineries or growing refineries, and in what type of processes, upgrading or clean fuels, in what areas do you see growth?

- A. First, refining is your 10% ROI. However, it is a necessary evil, so to speak. The only way you can bring those fuels is to refine them. But refining as an industry is a very low return industry, and for many years there was no more – there is a lot of refining in the world. I think the refining in Europe and all over is a tremendous number. It is really what type of refining, because today there is a requirement for cleaner fuels, also different crudes that are available in the market. In Saudi Arabia we moved back into refining. We are a big refiner. In Saudi Arabia we are refining roughly two million barrels today. But Saudi Aramco today is putting two new refineries, 400,000 barrels per day, one in the Arabian Gulf with Total and one with ConocoPhillips on the other side. These are going to process the Manifa Arabian heavy and will be producing 900,000 barrels per day, split between the two refineries. I think we see there are lot of refineries coming in India.

There are a lot of upgrades; we are upgrading our own refineries and everyone else is upgrading. The economics of upgrading is, of course, much better than grass-roots refining. But I think the growth area will be in Asia, and this is where you are going to see additional refining. Saudi Aramco, also with Shell, doubled the size of our refinery in Port Arthur in Texas and in a couple of years this will be the biggest refinery in the United States of America. So also America does have more market for additional refining. Upgrades are, of course, your first choice, and then grass-roots but very complex refineries, and therefore the cost is becoming horrendous, because we have also to deal with the environmental aspects of crude oil and products. But some of these refineries that we built many years ago at \$3 and \$4 billion, now they are running in excess of \$10 billion.

Nicholas Beale (Sciteb Ltd): You have spoken very eloquently about the need for greening technology, and I think perhaps we could agree that in the medium term at least, the limiting factor on petroleum consumption is going to be that for every billion barrels that you consume, somebody is going to have to capture at least a million and one barrels of carbon, one way or another. But there is a severe problem of incentives, and I wonder if you could address how in your view this incentive problem that we have can be dealt with.

- A. I am really not the expert and when John and I talked about this this afternoon I did not comment. When I was talking to him I said really this is a very complex issue. Of course, on our part we are doing a lot. The country is doing a lot, in Saudi Arabia, and Saudi Aramco itself is doing a lot. It is going to cost a lot, at the end of the day somebody will have to pay for it, and at the end of the day it will be consumer that is going to pay for it anyway. That is the only way you do that. But this is a complex issue, and I am really not an expert and in Arabic we say, “Blessed is the man who can say, ‘I don’t know.’”

Peter Broughton (Peter Fraenkel & Partners): I work for a small firm of consultants, Peter Franks, and I have spent most of my life in the oil industry working for American operating oil companies. I think what you gave tonight for me was a ray of hope and encouragement. It is a bit like the speech given by American managers to young engineers in oil companies 35-40 years ago and I find that very encouraging. Sadly today here there are very few politicians in this room prepared to listen to what you have to say, and I think that is the sad part about it.

Now if you come back to the UK, from my perspective, we have a terrible habit, certainly in my lifetime, of crashing industries and letting industries go, and one of my concerns is that we will let our technological base for oil and gas development go. We have let our nuclear industry go recently, in the last 30-40 years. An eminent politician said he knew of seven nuclear engineers left in the country and they are all now retired. So we have to buy in from overseas, and I do not want to see our oil and gas industry go down the same way. What is happening in this country, we have had ten years of mish-mash talk about all these renewables and all this sort of stuff. We had increased taxes on oil development in the North Sea. We have had oil companies moving out of the North Sea, big oil companies. So we need a reversal of that trend. We need to encourage young engineers going into the industry and building up our technical base, what you described. Thank you very much.

A. Thank you.

Philip Greenish (Chief Executive, Royal Academy of Engineering): Mr Jum'ah, you started life as a political scientist and I would like to ask you a slightly political question. The developed world has for long worried about the political stability of oil-producing parts of the globe. Iran and Iraq are perhaps examples of that. We have also seen countries claiming stakes in the Arctic. Do you think our concerns are overstated? As demand rises, how do you see stability being maintained?

A. I am a pseudo-engineer, I am not a politician; I am not quite an engineer. I had a political science education, but I have been acculturated by the engineering environment of the company. Conflicts are a way of life for us. This is not new, and conflicts and due political problems are not just the privy of the oil-producing nations. It is all over the world. We see it whether you have resources or you do not. Unfortunately, the history of humanity is a history of conflict. But normally conflicts get resolved, after all. Iraq is out of the market for quite some time. That geopolitical reality had its toll on the oil price. I think the sabre-rattling that we have seen, and we hope it continues to be sabre-rattling, although it has abated with Iran, hopefully will abate. But I think under very difficult circumstances energy has flowed anyway. Yes, you had interruptions here and there, but the interruptions in energy have been for rather a short period of time rather than a long period of time, and therefore I am not worried about – I am worried about conflicts. But I am not worried that one way or another that energy is going to flow to the market anyway.

Adrian Pattison (npower renewables): I would like to ask another climate change-related question. I think I am right in saying that your vision you outlined at the start of your presentation was one of continued long-term increase in the amount of fossil fuel that we burn, however efficiently that may be. How would you say that is compatible with the modern understanding of climate change? My understanding is that in reality it is not compatible.

A. One, as you see I mentioned the IEA, the International Energy Agency, which represents basically the OECD countries. So the agency that represents the industrialised world, that is also going to be in Copenhagen and so on, is telling us that fossil fuels are going to be here for the long haul. So this is not what I am saying. As a realist, I say that is a possible scenario because the alternatives are not there. The problem with alternative fuels, if you may, is that the political rhetoric has caused many people to believe that there is an energy solution other than fossil fuels that is around the corner. I have spoken at Harvard University, I have spoken at MIT, I have spoken at Stanford University, and I was amazed at the degree of ignorance

of some of the people who should be intelligent, people who truly think and believe that alternative fuels and ethanol are the panacea for our energy problem. All I am saying is let us be realistic. There are no alternatives today. There are alternatives, but they are giving us very limited – I will just give you an example. In 2008 the world was consuming 240 million barrels of oil and oil equivalents per day, in 24 hours. So in the hour and a half we would be sitting in this room, the world has consumed in excess of 10 million barrels of oil and oil equivalents. The alternative fuels, if you take as ethanol, is really minutes of consumption of the world.

All I am saying is that we have to be realistic. I realise and believe carbon management has to be done. Carbon has to be sequestered or something done about it. It has an effect. Whether the jury is in or out on the effect of carbon on the environment is immaterial. In Saudi Aramco four years ago we brought experts from all over the world and we convened the first conference in our part of the world to bring awareness to the public about carbon management and the need for environment protection. There is a lot of interest on our part. So we brought people from all over the world, we convened the conference to tell people, "Listen, this is a problem. We have to handle it. We have to work on it". It is not as though we are like ostriches putting our heads under the sand, but we are trying to be realistic. Today the base of the world economy, the base of our way of life, the base of your children going to school, my children going to school, the material we wear, the cars that take us, the planes that take us, it is hydrocarbons and fossil fuels. It is just being realistic. That is what I am trying to say. Is it a problem? It is a problem. But the thing is do we say, "Okay now, I'm not going to use oil"? No-one is forcing people to use oil and gas or fossil fuels. The question is realistically, today you cannot live without it. That is what I am saying.

Mark Cosic (Makani Power Inc): I work for a bit of a left-field company developing gigawatt-scale windpower, but I could just as well work for a giant solar company or a fast-breeder nuclear reactor company. I am interested in synthetic hydrocarbons, specifically making hydrocarbons – methanol, natural gas or liquid fuels – from CO₂. Much as I like the ostrich, I think I agree with everything you have said, but I would still like to avoid digging oil out of the ground. I would like to close the carbon cycle by converting it back into a fuel again using some other energy source. What price point do you think you can give me between 2030 and 2050, and what is the R&D budget in the oil firms for going beyond the 20-40 year future and 50-70 year future? [Pause] What is the price of oil going to be in 30-50 years?

Lord Browne: If I can summarise your question, sir, it seems to me that you have asked two questions. One is what price oil has to be to create some new sources of energy, and in particular, your second question is will carbon dioxide be used to create some other form of fuel, by which I assume you mean biomass of some sort.

Q. Probably natural gas and ethanol.

Lord Browne: Natural gas.

A. That is a question for the engineers! As to price, I will not even give you the price five minutes from now, because if I knew with certainty what the price is going to be tomorrow, I would be a billionaire. No-one knows what the price is going to be. Now what should or should not be price? I cannot give you a number, but I think what you need only, it is a price that is capable of having a return for the investment. Most of the countries that are producing oil, particularly in the Middle East, depend heavily on the oil revenues for their budgets, to balance their budgets, and also to give them

enough to make additional investment. Saudi Arabia made a commitment, and in fact I had a mandate when I was CEO of Saudi Aramco, for Saudi Aramco to continue to keep between 1.5 million to 2 million barrels of extra capacity all the time, so that the world cannot see a hiccup, when there is a problem like Iraq or Venezuela, and we have used that capacity during these problems. Today Saudi Arabia probably has in excess of 3.5 million barrels of extra capacity available.

The other question I really cannot comment on, but I would like to mention something very interesting, that there is a lot of emphasis also in Saudi Arabia and Saudi Aramco on alternative fuels. For instance, King Abdullah University of Science and Technology, KAUST, is going to open its doors, a graduate university on the west coast of Saudi Arabia, and one of its major activities is going to be solar energy. So there will be a great concentration on solar energy. You may have seen the 60-minute interview with myself and the Minister of Petroleum of Saudi Arabia where he said, "We are today a major exporter of oil. In the future we will be a major exporter of electricity", because of his belief that there will be a lot of work done on solar energy, and I have always said that the country that has the biggest reserves of sun-rays in the world is Saudi Arabia. So we have oil and solar energy.

Lord Browne: On that note, thank you. Let me before we thank you say first, thank you very much for coming here and giving this lecture and answering the questions. The good thing about lectures, of course, is that we do not all have to agree with everything that has been said, and I think that is very important in a lecture. But one thing we do go away with is a clear message from Abdullah Jum'ah that there is probably no limit to the amount of oil that can be produced and that technology continues to make it possible to produce more. So it clears up one uncertainty perhaps in our minds on supply.

But I would guess that when it comes to the supply of energy, the uncertainties are not on the supply side. We know that there is a tremendous amount of sun incident upon the earth. We know that there is an awful lot of material which can be converted into biofuel. There is plenty wind. There is an enormous amount of geothermal. There is a lot of coal. There is a lot of oil. There is a lot of gas. So the supply side seems to be not that uncertain.

What is uncertain, and I do think it is the uncertainty that creates the debate – which will carry on, hopefully not for ever – is the question of who will demand what and on what basis will it be demanded, what will be included in the price of energy and how will that develop our tastes for what fuel we demand, how much we demand and when we demand it. That is something which can only be resolved, I think, between nations and within nations, and perhaps the start of that journey, but I think certainly not the end of it, will be in Copenhagen this year.

Ladies and gentlemen, thank you for coming. We should thank Mr Jum'ah for his lecture. Thank you. [*Applause*]

[*Ends*]