

COLIN CAMPELL
THE DECLINE OF THE PETROLEUM AGE

Colin Campbell, from the UK, is a petroleum geologist who has worked with BP, Texaco, Fina and Amoco. He was Exploration Manager for Aran Energy in Ireland, and has been a consultant to various governments and to Shell and Esso.

In 1998 he and Jean Laherrere were largely responsible for convincing the International Energy Agency that the world's output of conventional oil would peak in the following decade. He is the author of two books and numerous papers on oil depletion and has lectured and broadcast widely.

This exclusive Global Vision video interview was produced and directed by Michael O'Callaghan at the conference on Ireland's Transition to Renewable Energy organised by the Foundation for the Economics of Sustainability (FEASTA), at the Tipperary Institute in November 2002 in Ireland, shortly after the World Summit on Sustainable Development (WSSD). The video version will be published here later this year.

TRANSCRIPT (7,609 words, slightly edited for clarity):

What is your perception of the global energy supply?

People ask are we running out of oil? Since it's a fossil fuel formed in the geological past, we started running out when we produced the first barrel. So the real question is, how far along this curve of depletion have we come?

It's not a particularly difficult concept to grasp. There's a certain relationship between the discovery of oil and its production, and there are many different categories of oil. There's a huge difference between a Middle East well flowing at 30,000 barrels a day and digging up tar sand in Canada with a shovel. So there's a need to define precisely what we are talking about. One of the reasons why this subject is not better understood is a failure to establish proper definitions of what we're trying to measure.

Conventional oil is the cheap easy kind that has furnished most of the oil to date. It will dominate all supply far into the future, and it is this kind of oil that will determine when the peak [of production] arises. It's quite obvious that to produce oil you have to have first found it, so the starting point of trying to evaluate these things is to establish a discovery trend. If we knew the pattern of past discovery it wouldn't be so difficult to extrapolate it. And while we may not know initially precisely how much a particular oil field contains - we may need special technologies or special economic conditions to eventually produce it - this transcendental moment of discovery is the important thing, because that determines the future progress of developing this resource.

Let's start by evaluating the discovery trend. There is no particular technical problem in determining the size of an oil field - the oil industry does this every day of the week. The great problem arises over what is reported, so let's

spend a little time discussing this issue. We have to go back to the early days in the United States, where the mineral rights were owned by the landowner, so the oil fields had a highly fragmented ownership. There was no shortage of promoters and swindlers who were exaggerating the size of their resource for commercial reasons. So the Securities and Exchange Commission moved in to establish very strict rules over what you could claim as a reserve. To put it simply, they defined it as what your current wells could produce or could reasonably produce, and it actually said very little about what the field as a whole could produce. This quite pragmatic and simple arrangement which started in history has stayed with the industry. The oil companies have found it attractive because it meant they could under-report the size of their discoveries, so they had a store full of under-reported reserves that they could draw down to create a kind of smooth pattern of discovery and provide a better image to the stock market. It also saved a great deal of tax, because the lower your reserves the less you were taxed. So there were many pragmatic and normal reasons for this practice, and for most purposes it doesn't matter.

But to establish a discovery trend - in order to find out how much is to be found and produced in the future - we need not only the right amounts but also the right dates. In the case of a large old field, the amount reported would initially be probably 30% less than what it would eventually produce, and so the reserves grew over time. So we have to back-date all of that to the discovery of the fields concerned. And when we do that we find that world discovery reached a peak in 1964 and it has been falling every since, with fluctuations from year to year. But the overall trend has been downwards: a firm, robust downward trend which shows that there's only a limited amount to find in the future.

This isn't difficult to do in scientific terms, but the data with which to do it is very hard to come by because it is not in the public domain. It does not correspond with the oil companies' financial returns. And furthermore many governments - especially the OPEC governments - have exaggerated their reserve base for all sorts of other reasons. So we really need a detective more than a scientist to plough through all the evidence, collect the clues, and come together with a reasonable estimate of what is there. If you go through this exercise you find that about 875 billion barrels have been produced so far, reserves stand at slightly under 1 trillion barrels, and we have yet to find something in the order of magnitude of 150 billion barrels. When you put all of these numbers together, it tells you that we are approaching the half-way point within the next few years. Talk to a beer drinker, he knows that the glass starts full and it ends empty; when he's drunk half of his glass he knows there is less left than he has drunk already. This analogy gives you an idea of where we are in terms of depleting the world's finite glass of oil.

When we turn to the question of production, we can draw a rather simple bell curve which starts and ends a zero and reaches a peak more or less in the middle. So it's quite simple to draw a bell curve to show when the peak comes. In world terms this natural bell curve was interrupted by the oil shocks of the 1970s when high prices curbed demand, so the actual peak came lower and later

than would have otherwise been the case.

Then we have to look at where this oil is located. About half of what remains to produce lies in just five Middle East countries, and they can exercise a certain swing role around peak, making up the difference between world demand and what the other countries can produce within their natural constraints.

And so we have a rather complicated picture. Without being too precise about it we can say that the half-way point is likely to be reached around 2005. And I would picture that recession is now here to stay. It was triggered in part by the fact that the world reached the capacity limits of oil production in 2000. Oil demand fell as a consequence of recession, so there was a re-adjustment in price. A lot of factors like this lead to a plateau of conventional oil production that could go on to 2010, by which time I think the Middle East countries in practice - never mind what they might be able to do in abstract terms but in practice - will no longer be able to offset the natural decline elsewhere, and from 2010 onwards we'll see the beginning of the long-term decline of oil at more or less a 2 to 3 percent depletion rate a year.

Now superimposed on this conventional oil - the easy cheap stuff - we have a number of other categories to be considered. There's the deep-water oil, there's a new domain that has been opened in extremely deep water under very exceptional geological conditions, under very difficult operating conditions. A number of large fields have been found, mainly concentrated in the Gulf of Mexico and along the margins of the South Atlantic in Brazil and offshore Nigeria and Angola. If we add that kind of oil we have another peak also around 2010. In addition, some more polar oil may come in from the Arctic regions of Russia although we don't know so much about that. The heavy oils of Canada entail a mining operation: they dig the stuff up and process it; it's energy intensive, and has high environmental costs. They will no doubt gradually increase the production of this stuff in the future, largely for strategic reasons since it lies in North America. Then in addition we have gas. A lot of liquids condense from gas when it's brought to the surface, and I think that they too peak around 2010. So we can say that the world liquid hydrocarbons will reach their peak around 2010 and begin to decline thereafter.

Well since this is just less than 10 years away, future production need not fall below present levels for about 20 years. So this is not an immediate cliff that we're falling over, we have a little time to prepare. But I think the perception of this situation will cause shock waves as it begins to filter through to business, to the academic community, and eventually even to governments perhaps. Oil has been produced for 150 years now, and it's interesting to note that the world population has increased six-fold. If you plot oil production and population side by side they exactly match each other. So the world prosperity and the number of people it has been able to sustain have been heavily influenced by this availability of abundant cheap energy from oil - it's as if each of us had a team of slaves working for us for next to nothing! Well, this 150 year epoch which included the Industrial Revolution and which has seen the whole extraordinary expansion of the last fifty years is about to come to an end around 2010. As this physical moment approaches,

the perception of it becomes widely seen and I think it will have a quite dramatic effect on the way in which people view their own lives. Many business decisions will be built not on the perception of perpetual growth as in the past, but in trying to deal with decline and difficulty and more tough conditions. And I suppose at the end of this trail of perception will be the politicians who will eventually have to reflect the feelings and the wishes of the people.

So we face on one side a physical crisis imposed by nature, due to conditions in the geological past over which we have no control, and more important than that itself are the social, political and economic consequences of how the world faces up to this situation which is new to its experience. Many people say the stone age didn't end because we ran out of stones, it ended because man found a way of melting gold, and later he got copper and tin and made bronze, and so found a better material to replace the stone he had used before, and bronze eventually gave way to iron and steel. This was a pyramid of progression as man voluntarily moved up the staircase finding better materials and more efficient ways to do things. Well, this whole long staircase of progress ends up around 2010, and heads downwards because we now have no substitute that comes close to matching oil and gas in terms of convenience and low cost and everything else.

But that's not to say the world comes to an end. There are many solutions and we can picture a number of things. We can picture a reduction in affluence, we can picture a change in this sort of addiction to the market forces of the world, this abnegation by the governments who seem to dedicate themselves to this abstract notion of the market. We could come back, let's say, to life in the village of Ballydehob where I live in Ireland. I spoke the other day to Peggy Coughlan, the elderly post-mistress in the village and I said "has life improved in the last 50 years?" She said without hesitation that "yes, of course it has!" And then I asked a rather more penetrating question when I said "well, was it bad before?" And she thought for a moment before answering and she said "No, no, it wasn't bad. We were as poor as church mice" she said, "we had nothing; our family had to club together to buy a white shirt for my father who was the schoolmaster; and us girls used to spend our evenings darning our black stockings for school, and we'd think nothing of walking ten miles to a village dance. But we would meet in people's houses for drinks and parties, and we had fun and we'd sing." And she said there was a spirit of co-operation in this village at that time: people helped each other; everybody put in a hand. And I must say that even today you find the same kind of underlying feeling in the village. It's extraordinary how we've had a lot of work done on our house, but it's difficult to pay the people doing it; it's a sort of embarrassment for them to come and present the bill!

So arising out of all of this wider oil picture, you may find a return to more local kind of communities where people live in better harmony with themselves primarily, with each other, and above all with their environment and the natural resources that are at their disposal. They may live much more simple lives than we do today, but that's not to say they may not be happier lives in many respects.

So we still have as much oil left now as all the oil we have already taken out?

Yes. We will eventually run out of oil, but not for very many years. We have used as much in the past as we have left in the future, approximately. But this change from having more in front of you to having more behind you is a fundamental turning point that affects the whole way in which the world lives. Consider the global geopolitics of this whole situation. The oil industry had its roots in the United States. The first well was drilled in 1859 in Titusville, Pennsylvania. The United States has a very important message to deliver because discovery there peaked in 1930. The United States had the money to do it, it had the incentive, it had the technology, so the fact that discovery reached a peak - and then declined inexorably for the last 70 years - is not for want of trying. It was due to the physical limits of what nature gave them. The corresponding peak of production came 40 years later, in 1970 - a long interval between peak discovery and peak production. And for the last 30 years it has been falling inexorably and there's nothing on God's Earth can change that.

But won't the amount of time it will take to use up the remaining supply be much shorter, especially because of increasing consumer demand in China and other developing countries whose populations are rapidly expanding?

Well, the United States depends on foreign imports, mostly from the Middle East. It has long been official US government policy that access to foreign oil is a vital national interest, justifying military intervention where necessary. Up till now, this potential threat of military intervention was based on the fear of temporary interruptions, where some country might stop exports for political reasons. But the situation has now changed because the US is no longer facing just the prospect of temporary political interruptions, it is facing the iron grip of depletion. That means that not only is the United States depending on Middle East supply, but so is the rest of the world. China is desperately trying to increase its economy, it has aspirations to be a two-car family like everybody else. And China has been very thoroughly explored by the Communists, albeit with rather primitive technology, but this was offset by the sheer level of work that they do drill. They drill wells on five-acre spacing. They drill thousands of wells very close together to compensate for the rather limited technology. So the Chinese are going to be looking for access to Middle East oil. The Third World, Africa, although their needs are small, they're also going to be wanting access. And under the principles of globalism, this new globalism idea, it's a tenet that the world's resources should be available to the highest bidder, which is clearly the United States at the present time. So we face a conflict, the first steps of which are already being unfolded in front of us. Access to these oil supplies - which are critical to the agriculture of the country, to their well-being and to their whole economy - is moving from being just a market-driven thing to which political incidents might be superimposed, to being limited by the iron grip of depletion. This is an entirely new situation!

And we must not forget Russia. Discovery in Russia peaked in the late 50's.

They were quite efficient explorers, because they were freed from the commercial criterion. In the West we always had to drill wells on the basis of expecting them to deliver. In the Soviet Union they could drill wells to get information, scientific information. They approached it really more logically. So discovery peaked there, and in the last days of the Communists they really raped the reservoirs. They over-produced them, water entered, they caused all sorts of damage to the reservoirs simply because of the desperate condition they were in. After the collapse of Communism, oil production just fell like a stone. Now, ten years on, it's beginning to recover. The Russian oil barons are beginning to appear now, and the Russian oil companies. They are increasing production, making good what they would otherwise already have produced but for the anomalous collapse at the end of the Soviets.

This brings us to the Caspian region, one of the world's oldest producing basins, already known in the middle of the 19th century. The Soviets had no particular reason or need to explore the offshore fields in the Caspian Sea, they didn't develop offshore rigs and platforms. But when the Soviets fell the place became available to Western interests. There was great enthusiasm for the Caspian, and the Western companies moved in. The United States government was partially misled by a great wave of optimism that overcame everybody, and they said well, "maybe the Caspian gives us an escape from the stranglehold of our dependence on the Middle East", so exploration started in the Caspian. Without going into a lot geology we can divide the place up into several provinces. In the far South there's an area shared between Iran and Azerbaijan which is a deep Tertiary basin which is gas-prone and BP has indeed made quite a nice gas find there but nothing too exceptional. Then East of Baku, the world's ancient oil capital, there's a narrow belt which is the delta of the old Volga river, a narrow belt that runs eastward towards Turkmenistan, and this has delivered some nice offshore fields, but nothing to make any huge difference to the world, and ExxonMobil has now pulled out, which is never a good sign. The really great interest lies further North, where in 1979 the Soviets made a very deep discovery - at 4,000 meters - of very high sulphur oil (16% sulphur) at a place called Tengiz. But the Soviets didn't have the steel to deal with this high sulphur because it corroded the pipes and everything, and so they didn't develop this field. So later Chevron came in and is indeed now with some difficulty producing quite a large field, about 6 billion barrels of oil in a very deep structure which is actually an ancient reef. Later on they found the most enormous offshore structure, 200 miles long by 50 miles wide which looked rather like this Tengiz discovery. If this had been full of oil, it might have contained 200 billion barrels, making it the world's largest oil field.

So there was a great deal of hype about this, and you can picture back in the think tanks of America, and the foreign service departments and the military planners, all of these people seeing this great gem sitting out there in the Caspian, and their interest shifted to how to get the damn stuff out. Since they are obviously not geologists, it was sort of taken as an assumption that it was there, and the problem would be to export it and bring it onto world markets, which would help hold the price of oil down. And so a lot of emphasis was given to the control of the Caspian area - and oil must be the only reason anybody would wish to control the place - with a lot of discussion about

different pipe-line routes and so on. Many people see this strange Afghan war that developed no so long ago as one of the factors involved, although there may have been other motives as well, because it would be a rather convenient staging-point. It is outside the Russian orbit, it's kind of a no-man's land up there. There may have been a thought that to control

Afghanistan would indirectly give them control of Caspian oil, the pipelines and all the rest of it. So this seems to have been one of the motivations that led to that event.

However, they have now drilled three wells in this huge Caspian field, and they find that far from it being a single huge structure containing 200 billion barrels as they had hoped, it is made up of different individual reefs, also very deep, also high sulphur, and the latest estimates are it's only got between 9 and 13 billion barrels! Well 9 and 13 still is a very nice oil field, there's nothing wrong with such a thing, but it isn't going to make any real difference to world supply, and in fact BP and StatOil who were partners in the venture have now pulled out, which is never a good sign. So I think the conclusion is that the Caspian was a kind of chimera, a hope that was not materialised. And one can picture the kind of momentum of strategic planning and everything: they get the idea that this is some sort of target that we should control, and the small fact that it doesn't have the booty that you think it does takes some time to sink in to the square minds of the people doing all this. So what we find is that the Afghan war came to a driving stop. It didn't so far as we know achieve very much. It caused the fall of the government. This Bin Laden man they were supposed to be looking for was never found, and now it barely hits the television screen at all.

So what happened next? We suddenly find that for no apparent particular reason there is now a threat to invade Iraq, which stood next to the Caspian on the US list of places with undiscovered potential. So the cynic has some justification in saying well, the first venture to control the Caspian failed, so they moved one step down the list to try to control Iraq. One can picture a sort of committee - you know these governments run with committees - and one can think of the Israeli committee there, who say clearly Iraq poses some kind of threat to Israel so we would like to counter that threat. We could see the oil lobby on the other side saying, yes, we desperately need access to Iraqi oil, that would help us in our world supply situation. Also, the United States is heavily in debt. It has a kind of virtual economy built on foreign inflows, and the whole event of September the 11th kind of undermined world conference in the superiority of the United States and the dominance of the dollar and all those good things. So the lobby who thinks about such matters might say yes, it would be helpful to us to have a of campaign somewhere to really re-exert our world authority and do all of these things. So you could picture the interwoven threads of different interests that might lead the United States to this threatened invasion of Iraq. Of course this would be very simplistic, because it's almost inconceivable that the United States could hold in perpetuity all of those people in subjugation. The Palestinians tell us they don't give up that easily, and oil installations are certainly easy targets for any kind of resistance....

So all the forecasts and scenarios I spoke about earlier which were built on the resources and the general depletion imposed by nature, are now being overtaken by these political events. If the United States does eventually invade Iraq it will probably cause chaos and anarchy and breakdown of most of those Middle East countries whose stability are pretty delicate. The Saud rulers may lose control of Saudi Arabia. Some people say that this is indeed the hidden objective of the whole exercise, to create complete anarchy there so that the West can come and control the oil supplies. But I think this a very simplistic objective, and it won't by any means be easy to achieve. The likely result would be that oil prices soar through the ceiling, and if they do that there will be no recourse. But in a way there may be benefits from that too, because if oil prices are very high, attention will belatedly turn to renewable energies where a lot of things can be done. Attention could turn to reducing demand, could return to more sensible ways of living. I mean we come to Dublin and here we have all the most super-efficient Mercedes and BMWs and all these big cars - highly efficient pieces of technology - but what the hell are they doing? They're stationary in a traffic jam. That's not a very sensible way to live! So extremely high oil prices may have an unintended consequence of changing that way of life and bringing us back to a more sustainable future. You might see local communities gain strength, like Ballydehob that I spoke of before. I mean potatoes in Ballydehob leave a field in Ballydehob, are transported to the market in Dublin and are then brought back again, you know. This isn't a very sensible way to run things!

More generally I think if you had a more regional and local kind of basis for life, one would have less corrupt governments because the politicians would be closer to the people who they represented, so this would probably improve the calibre of the politicians, and in general people would have a kind of cohesion and co-operative feeling between them that would help them face this inevitable problem of the future. Some people speak of global solutions, and in some regards perhaps they do exist. But I feel the better way to go is to start at home and fix up your little corner of the world in some kind of sustainable, reasonable way. If everybody would concentrate in dealing with their own situation finding some solution in the local context of what nature has delivered them, it would make a lot more sense than being a victim of some distant globalised market controlled by all sorts of people you don't know.

Given current rates of consumption and so on - if war in Iraq doesn't happen and we avoid a sudden rise in oil prices - how soon do you think consumers will start to become seriously affected by oil scarcity?

The price of oil is very artificial. We face a very unnatural market in this business, because a very small shortage or surplus in the oil market gives a completely disproportionate impact on the price. Production outside these five Middle East countries reached a peak around 1997, and it would have been natural to see a gradual increase in price from then onwards. But in fact we had an anomalous fall due to warm weather and Asian recession and the devaluation of the rouble which had all sorts of incidental effects, and so we didn't see the rise in price that would have been natural until late 1990 when suddenly nature re-exerted herself and we saw a surge in oil price. At that

time the world had pretty much run out of immediately available spare capacity. Oil prices began to shoot through the ceiling went up through the thirties, and then we had recession. This was in part triggered by the perception of these high oil prices and the fear they might go on up, and so we had a recession which then reduced demand for oil, supply and demand were in better balance, and the price. The same situation will repeat itself if the economy should recover now. But as the years go by, the ceiling of capacity falls so it will come sooner: when we again hit the capacity constraints it will cause another surge in oil price, and re-impose recession in a kind of escalating vicious circle. So quite apart from whatever might happen in Iraq, I would say that people at large - in a matter of years if not months - will suddenly see these price spikes, see recessions and a lot of chatter will go on among the chattering classes as to the reasons. But the underlying thing is that this essential energy supply is beginning to show it's getting short. So, I think within the next ten years at the maximum we will be seeing oil spikes. I'm not saying they're going to stay up, because there is this very volatile market by the nature of the market, and a price spike will give rise to recession which indeed will solve the price again, in a continuing cycle. And it's a bad thing because this uncertainty created by the fluctuations in oil price means that investors are very reluctant to move into renewables. They don't know if there's a real need for them, you know, the situation is unclear. And that, combined with the general reluctance of governments to anticipate anything - they much prefer a crisis to which they can react, rather than to anticipate - delays the work and the changing behavior that we have to adopt.

What's your view of the solutions? For example, do you think there is a real potential for developing a hydrogen economy anytime soon?

Solutions? I'm better at the problems than the solutions...

You must have thought about them though.

Indeed! I would say the absolute simple first solution is to use less of the stuff! We are all so incredibly wasteful in the way we use energy that there's a great deal that we could do without any pain at all. That's the first step. Look at the situation in Ireland, for example. I heard today at this conference [the FEASTA conference on Ireland's Transition to Renewable Energy] this idea of tidal generators. It seems an eminently sensible approach to tap this source of energy in a country like Ireland which has a long coast-line and plenty of tides. It can't be so difficult technologically to produce some sort of rotor on the sea-bed. Ireland's an interesting place, you know! It has no oil or coal to speak of; one of the reasons for the whole tortured political history of Ireland is the fact that it was denied these essential industrial resources. We've been looking for oil in Ireland since the 1970s. I personally was involved with some of the early exploration here. 177 wildcats - these are the wells that try to find new fields - have been drilled here! And each of them costs about 10 million dollars. So one can say a trillion and a half dollars has been spent looking for oil off Ireland! And every well always tested the best perceived prospect at the time, so one's

tried 170 shots at the game. And there can always be surprises, it's not to say it's dead, but it would be a brave man to put much hope in finding new oil in Ireland. So the very worst thing Ireland could do would be to place much reliance on this dream of finding some mammoth new oil field off the west coast. In recent years Ireland has also depended on gas. It had this one small gas field off Kinsale Head, off Cork, and it's going to be exhausted due to depletion within the next few years. By great good fortune they discovered a rather anomalous find off Mayo - the Corrib field - which will be coming on shortly and this does give another lease of life. But demand for gas has been soaring recently because they turned to gas generation for electricity. And Kinsale Head wasn't enough to supply it, so they built a pipeline connector to Scotland to import gas. And this was perceived to meet the needs I

think until about 2015. But the demand has greatly increased, so it's already reaching its limits. Moreover, Britain becomes a net importer by around 2005. That means that poor Ireland is absolutely at the end of the pipeline, starting in Siberia or Central Asia or even the Middle East, for gas that will be pumped into Europe, passing all these transit countries, all of whom will by just geography have a prior claim on the stuff. And eventually it's got to make its way to Britain, and I already hear the politicians there are complaining about the burden of having to supply Ireland. It eventually goes from there to Scotland and then it crosses this connector to Dublin, and this is what Ireland is relying on for a great part of its electricity generation. Well this, this is a huge mistake! This is a monstrous vulnerability that Ireland is exposed to. The response should be to certainly stop doing any more reliance on gas. I think it's a great mistake to privatise the energy supply companies because it's a national issue. We're not trying to get the cheapest energy! The motivation of privatisation and the free market is supposed to make it cheaper, but that should not be our objective. Our objective is to make it more expensive, so that it should last longer, so that it would be a national asset controlled in a sensible long-term fashion. This privatisation thing is clearly a mistake, but it's a popular thing to do at the present time.

Moving on from there, we should develop every kind of renewable energy that can be reasonably done. It seems to me this tidal rotor offers the very best solution. I find these wind farms rather ungainly, they detract a bit from the scenery, and they are not constant, they fluctuate with wind supply, whereas the tide goes on relentlessly. I'm a bit less confident about biomass, maybe something can be done in that direction. I would have thought with sensible planning, sensible usage, it would be a very good idea to have an energy audit of every house. You would have a penalty if you were inefficient in your use of energy, and you'd have some incentive for being good at it. And so one could very easily cut the demand for energy quite radically. And I think with the proper use of renewables you'd get by for a while. And it's only a question of how soon you do it, because there's no avoidance of it in the longer term.

What about Ireland following the lead of Iceland?

As you know, they have a national policy of replacing the combustion engines in their whole fleet of cars, busses, and fishing boats with hydrogen fuel cells, and also producing the hydrogen locally from the surplus renewable electricity which they can generate from geothermal energy.

Iceland is a special case because it has the geothermal energy to produce hydrogen...

Yes, but Ireland has a huge untapped electricity surplus from wind and tidal power.

I don't see any great advantage in hydrogen. I wouldn't have thought hydrogen is the easiest stuff to use. I think electricity is much better use.

[For the pro-hydrogen view, see our interview with Dr. Werner Zittel of the European Business Council for a Sustainable Energy Future.]

After hearing about Iceland's hydrogen transition strategy, I spoke to Johnny Ronan of Treasury Holdings. He is one of Ireland's largest wind producers, and he told me Ireland has enough untapped wind energy to supply all of its own electricity, plus all of the UK and part of continental Europe as well. According to the Irish Times, a recent study found we have 13 times more untapped wind power electricity than we currently consume. So Ireland could be a net energy exporter. If this development of Ireland's renewable energy from wind or tidal power was publicly funded through the state, this could provide a considerable natural income for our people, like in some Gulf States where every citizen receives an income of something like fifty grand a year from the oil and gas revenues.

I would not export energy. It seems to me the worst thing to do because to have energy at all - it's still better to have cheap energy - gives you a huge commercial advantage over your competitors. Why the hell would you export the fundamental ingredient that your competitor needs? And I think it's unreasonable to have a windmill every 80 meters along the coastline. The mammoth scale of wind farms to do all that seems to me excessive. But I also think that Ireland's needs for oil are not very great. The population is small, it wouldn't be too difficult for Ireland's little entrepreneurial skill to run around the world and get some kind of privileged access to what remains. That's another approach: I would develop a special relationship with Norway, for example. But eventually of course the stuff will run out, definitely by the end of this century, so we have 100 years to make this fundamental adjustment. It's very hard to picture what it would be. Hydrogen is simply a matter of transporting energy. It doesn't occur itself naturally, so you've got to make the bloody stuff and...

But it has zero emissions in a fuel cell...

I myself am not particularly convinced by this climate story. I think the science is extraordinarily weak. I know in a geological sense there's been huge epochs of global warming in the past, and the degree to which this one is due

to Man's activities - it almost certainly is to some degree - but, em... And anyway I think to worry about the climate is putting the cart before the horse because that's a desirable option by all means, but dealing with your energy supply is a raw necessity, that really bites good. So if I was planning a strategy I would worry about my energy supply first, and worry about the climate after that. But strangely enough in political terms it's exactly the opposite way round. The climate lobby has an enormous following, and there are a lot of vested interests in that too.

I was talking to Claude Martin who's the head of World Wide Fund for Nature. He's Swiss and he comes from the mountains there. I asked him what has been the effect of global warming on the glaciers in the Alps...

Oh yes, they're retreating and he said they've lost 50% of their mass in the past 30 years!

But the ice-line has moved 17 times in the last 100,000 years, between Southern France and North Norway - long before man had any impact upon it. We live in Europe in a very vulnerable place because the Gulf Stream comes rushing across the Atlantic. There's a current down the Davis Strait, West of Greenland, and in times of warming the meltwaters deflect the Gulf Stream. It's like blowing at the base of a flame, a relatively small lateral push on this current shifts this Gulf Stream a few degrees, and this has an astronomical effect on the climate of Europe. So if we observe great climate fluctuations in Europe it's not to say they're all man-made. It's a vulnerable climatic condition because we're so dependent on the Gulf Stream. And I mean after all, Aleric the Goth managed to sack Rome because the Rhine froze in 406, and I wouldn't imagine this fellow was wanting to move South for any particular reason except that it got kind of tough at home, you know.

Let's try and clarify your views on hydrogen. Amory Lovins says the stone age didn't end because the world ran out of stones, but because we discovered metal, and that the petroleum age won't end because we run out of petroleum, but because of the invention of hydrogen fuel cells.

He's got to make the bloody stuff. I know of one project of trying to glass over the stony desert of Australia which has very high solar radiation, use this solar electricity to electrolyse water, with which to make hydrogen, and then from the hydrogen use coal there to transform this into ammonia and methanol which are easier to transport than hydrogen itself. So you ship this ammonia and nitrogen to Europe and then re-form it back into hydrogen. But this whole interest in hydrogen is primarily from a climatic standpoint, and I don't think it has particular meaning in relation to energy supply itself. Certainly hydrogen a desirable thing from a climatic standpoint, an emissions standpoint, but you've got to make the stuff in the first place. And a supply of ordinary natural gas will run a fuel cell perfectly well. There is this idea of a fuel cell under the stairs in everybody's house, you know, that would give heat and electricity and so on. So there are solutions in that direction too.

If I understood you correctly, you were saying in your talk earlier today that the oil companies are, at best, misinforming the public about the world's

remaining oil reserves.

Yes. Oil companies are generally decent people. To picture them as some sort of sinister group - if you worked for them you would never picture them in that role at all. But as I have already described, the reporting system was such that they reported extremely conservative reserves which they then revised upwards over time. They're in a difficult situation because when they make these revisions, they have to explain them! And to simply say "we under-reported it before" doesn't sound that great. There are financial implications and tax implications and so on, so it makes much more sense for them to say "this was the result of technology". There certainly have been advances of technology but they don't have much affect: the impact of technology is to hold production higher for longer - it makes more money but it doesn't really change very much the amount recovered. And then of course they have to live in the stock market like everybody else, and they have to present an attractive image of gradual growth. The one word they don't like to talk about is depletion! This smells in the investment community. So in a way the oil companies are the victims of the attitudes of the investment community, who are always looking for the good news and the image, and it's not very easy for them to explain all these rather complicated things, nor indeed do they have any motive or any responsibility to do so. It's not their job to look after the future of the world. Their directors are in the business to make money for themselves primarily, and for their shareholders when they can. So I think it's certainly true the oil companies shy away from this subject, they don't like to talk about it, and they are very obtuse about what they do say about it. They themselves understand the situation as clearly as I do, and their actions speak a lot more than their words. If they had this great faith in growing production for years to come, why did they not invest in new refineries? There are very few new refineries being built. Why do they merge? They merge because there's not room for them all, it's a contracting business.

Why do they shed staff, why do they outsource people? BP aims to have 30% of its staff on contract. This is because it doesn't want long-term obligations to them. The North Sea is declining rapidly. They don't like to say so, but I think only four wildcats were drilled there this year. It's over! It's finished! And how can BP or Shell and great European companies stand up and say well sorry, the North Sea is over? It's a kind of shock that they don't wish to make. It's not evil, or there's no great conspiracy or anything, it's just practical daily management. We live in a world of imagery and public relations, and they do it fairly well, I'd say.

A final question: what's the most important thing that young people should be aware of for the future?

I'd say that your parents thought more about themselves than they thought about you! Not a kind thing to say, and it was unintentional and not deliberate. But the youth of the future will face a hugely more difficult life than we do. I suppose that those who appreciate that and find some kind of a niche and are not too ambitious about how much money they are going to make, and take a more philosophical view of their position, they can be still be very happy. But it will be a rather different life.

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Lynn Dohner