

## Jan van der Eijk of Shell on 'three hard truths'

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Interviewer: That's Jan van der Eijk, Chief Technology Officer for Shell, and your listening to Earth Sky's Clear Voices for Science pod cast. With its head office in the Netherlands, Shell describes itself as a global group of energy and petrochemical companies with operations in more than 110 countries and major investments in Research and Development. Dr. Van der Eijk leads Shell's science and technology programs and today he's speaking with Earth Sky's Jorge Salazar about what Shell calls 'the three hard truths'.

Dr. Van der Eijk, welcome to Earth Sky's Clear Voices for Science.

JvdE: Thank you very much, I look forward to this interview.

Interviewer: It's our understanding that Shell, as a company, has articulated what it calls the three hard truths of the world's energy needs. Can you tell me, what are those truths?

JvdE: The first hard truth is that the world's energy demand will grow and it will actually grow substantially. This is driven by a growth in the world population, but also in an improvement of living standards in areas of the world like China and India. That's number one.

The second hard truth is that the supply of energy from conventional oil and gas sources will struggle to keep up with this growing demand and we will need new sources of energy, ranging from renewable energies to also unconventional oil and gas.

Then finally, this increase in energy demand and also the need to use all kinds of sources of energy will lead to an increase in CO<sub>2</sub> emissions and we all know that these CO<sub>2</sub> emissions are related to global warming. So that's a major concern and also something that calls for aggressive action.

Interviewer: May I follow up on that thought about Shell's commitment to do something about the CO<sub>2</sub> problem that's involved with producing energy? Why is Shell interested in this? Why is this something that's important to Shell?

JvdE: This comes to our belief that rising CO<sub>2</sub> levels are very likely to lead to warming of our planet and that global warming is something that has unacceptable consequences for mankind, at least unpredictable consequences for mankind. We believe it is time to take action in this area now.

Interviewer: Tell me a little bit more about these new efforts that Shell is doing in tackling the CO<sub>2</sub> challenge?

JvdE: People talk about CCS – it stands for CO<sub>2</sub> carbon and carbon capture and sequestration and just to say it in layman's terms it's when we are burning fossil energy we make a gas, called flue gas, that contains CO<sub>2</sub> but also nitrogen and a number of other things. One of the main programs that we, but also other companies have, is how can we effectively take that CO<sub>2</sub> from this particular flue gas stream, but also from streams that we

produce in our refineries that are sometimes a bit more concentrated than flue gas... how can we effectively take that CO<sub>2</sub> from that flue gas, then through pipelines, bring it to a location where we then are able to inject that in the subsurface - that's called sequestration or storage - and then to make sure that the material that we have stored subsurface is going to stay there for many, many centuries to come. The research that is done by Shell and other companies is about improved capture techniques, to bring the cost down and to also bring the energy consumption associated with capturing down. But then to focus very much on the subsurface. Understanding what happens if you inject CO<sub>2</sub> in the subsurface. Where does it move to? Would it actually react with the rocks? Would there be a chance that, over time, that CO<sub>2</sub> starts to come to the surface? There is a lot of work going on in that space to basically provide the assurance that when you store CO<sub>2</sub> it will be there for many, many centuries to come.

That is an effort that Shell addresses, but we're definitely not alone and we also realize that this is a subject where you really need to work together with governments, other industry partners and academia. Some of the topics we're talking about are just too big for a single company and new ways of working together between the industry, governments and academia are really necessary.

Interviewer: Tell me a little bit about the role of technology and how new technologies might help us deal with some of these truths that you've described.

JvdE: This is a good question. Let's first focus on technology that helps to make more energy available. As I mentioned, the first hard truth is that there will be more demand for energy. Technology at the moment is helping us to increase the recovery of hydrocarbons from existing resources, so you have to think about the resources like you have in the Middle-East. Recovery rates today are about 35 percent and we're trying to push this to higher numbers, let's say up to fifty percent, by the application of modern control techniques, but also by the injection of chemicals, for instance, to release more oil from the xxx. Then we are also working hard to get new energy from difficult locations and here you have to think about very deep water. Today the industry is able to produce hydrocarbons from a subsurface that is covered by more than two kilometers of water and also finding ways to recover oil in the Arctic, where the environment is extremely sensitive and we need to have techniques to not disturb that region. Then we are also moving to, what we call unconventional oil and gas, where the composition of the oil or the gas is difficult. Here you have to think about the heavy oils, for instance, in Canada and Venezuela, but also the vast hydrocarbon resources in the United States, these are the oil shales. But there are also vast resources of hydrocarbons, gases that are contaminated with H<sub>2</sub>S and CO<sub>2</sub> and if only we were able to efficiently separate these contaminants from the gas we'd have a new source of energy. So there is a massive investment in the industry, and also in the company I'm working with, to make more fossil energy available.

Interviewer: Can you tell me a little bit about some of the projects that Shell is developing in these areas?

JvdE: I'm more than happy to do so. Our company invests very substantially in research and development. In fact, we are the biggest investor in R&D in our industry. We believe that technology differentiation is the way for us to grow the company. We build also on a history of technology first in many areas.

Just to mention a few things, we have worked very hard to turn gas via a process involving synthesis gas into liquids that can be used in the transportation sector, so this is a way to use gas for the transportation sector. In the past, of course, this was all coming from oil and not from gas.

And we are having a plant in Malaysia that actually produces these excellent transportation fuels, and we are now building a very large plant, the biggest in the world, in Qatar, that will produce more of these so-called GTL liquids. Then we focus very much on pushing the boundaries on deep water, ultra-deep water. We recently announced further investments in the Gulf of Mexico, but also near the coast of Brazil and in Malaysia. This is an area where Shell every time adds a few hundred meters of water depth to its record. It opens up the energy that's available at these reservoirs below sea-levels.

Then we're working very hard on unconventional heavy oils. We have a new technology that makes that heavy oil that's very difficult to produce, available. We do this by having something like a subsurface refinery where we convert these very heavy molecules into lighter products that we can then easily produce. We're very proud of that development and hope that we are able to harness that to substantial commercial production.

Then we have coal gasification. We are having a technology that gasifies coal and allows you to have clean coal energy. That is a way to avoid that all the contaminants in coal end up in the air. I think that's a major contribution of the company to make responsible energy available.

And then – I'm just going on here – there's biofuels. We have a substantial program with a number of different start-up companies that are all aiming to make biofuels available from sources that do not compete with food. Here you have to think about agricultural residues or forestry products, or maybe in the future, algae that you can grow in seawater farms. So, in short, we have a long list of projects all pursuing two common themes. One is more fossil energy, and we do that in response to this first hard truth, that the world needs more energy, and also work hard to reduce the environmental footprint of our energy and that is in response to the third hard truth that the environmental constraints are growing.

In the context of some of these new technologies that you've described, is there one that has really grabbed your imagination as something that is extremely important and something that is powerfully grabbed your imagination here, that could really make a difference down the road for people?

Let me just take two. One is this technology that we are developing to convert heavy oils subsurface so that we can produce that. What we're doing is we are having a technique to heat the subsurface in which the heavy oil is contained and bring it to a temperature where the molecules in the subsurface start to crack and then we are producing the lighter components and turning them into fuels whilst we leave some of the heavy fractions back in the subsurface. This is something I'm really fascinated by and this whole idea of having something like a subsurface refinery I find, not only scientifically exciting, but I believe it has a tremendous potential to unlock a number of sources that with current techniques are actually not possible to produce economically, and if you do, with undesirable environmental footprints.

The other area I'm personally really excited about is exploration. This is all about finding new oil and gas. This is of course important to the world, because we need more fossil energy and if you just look at what new techniques around seismic gravitational difference measurements, electromagnetic radiation and the interpretation of all the reflections that you get from the subsurface when you treat the subsurface with these waves, it is really fascinating to see how much we can learn about the subsurface from these techniques, applying also high-performance computers that are able to convert and process enormous amounts of data. I think that's an area where we're really at the cutting-edge of science. It's also an area that has a very practical use and that is that we are able – much better than in the past – to identify where hydrocarbons are and also getting more efficient at finding the resources and then producing them.

Two very different subjects, one about chemistry and catalysis and the other about

measurements and data processing that both are giving an enormous upswing to this industry.

Interviewer: What is the most important thing that you would like the public to know about these three hard truths of energy that you described?

JvdE: I think... It's not so that it's important for them to be able to reproduce these three hard truths. What is important is that people start to realize that fossil energy is a finite resource. And that we need to find ways to use that energy in a more responsible manner. I believe this comes back to, not only the technologies I've described today, but also technologies that allow people to use less energy. This has to do, for instance, with buildings, lighter cars, insulation of your buildings, but also I think different choices of consumers. I think, over time, we need to realize that we have no total freedom in using this precious resource, but that we need to do more about conservation so that we leave enough behind for the next generation and the generation thereafter. I think that is, I personally believe, the biggest message for the broader society is we need, together, to start using energy in a different way than we did before.

That was Jan van der Eijk, Chief Technology Officer for Shell on what Shell has identified as the three hard truths of meeting the world's energy needs. Our thanks today to Shell, encouraging dialogue on the energy challenge. To subscribe to this and other free science pod casts, visit the subscribe page at [earthsky.org](http://earthsky.org). I'm Debra Bird and you're listening to Earth Sky's Clear Voices for Science pod cast.

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