Harold Vinegar on retrieving oil via in-situ upgrading

Vinegar: I think the unconventionals will play a major role in the world's energy future. I think they have to.

Interviewer: This is Earth Sky's Clear Voices for Science and that was physicist Harold Vinegar, a chief scientist for Shell and an expert on unconventional oil. Those are reserves of oil that can't easily be pumped to the surface. Dr. Vinegar spoke of their potential for the coming century with Earth Sky's Jorge Salazar and about a new way to recover unconventional oil by drilling holes and placing heaters underground.

Dr. Vinegar, welcome to Earth Sky's Clear Voices for Science.

Vinegar: Thank you, great to be here.

Interviewer: Last week we spoke with Jan van der Eijk about what Shell calls the three hard truths. Please tell us your thoughts about the second hard truth that he mentioned, that easy oil and gas won't be able to match the pace of growing demand.

Vinegar: The world's energy demand is growing rapidly. It's expected to double by 2050. That's really hard for easy oil to keep up with. By easy oil I mean oil that's easy to reach and easy to recover. It's extremely unlikely that it will be able to keep pace with that growing demand. Increasingly we have to look in more difficult and extreme environments. Places like ultra-deep water and in the Arctic. And in particular we have to go after resources that are much more difficult to produce, such as the unconventional sources of oil.

Interviewer: So tell me a little bit more about this unconventional oil. You're known as an expert in this field at developing innovations in getting at unconventional oil, which include oil shale and oil sands. Tell us more about this. What are they and where are they found?

Vinegar: Oil shale is a very dense rock that contains solid organic matter, which we call kerogen. When this rock is buried for millions of years, the heat and pressure in the subsurface cause the kerogen to slowly mature and expel oil. Oil shale is typically found at relatively shallow depths, because if it is buried deeper, it will already have expelled its oil charge. So it's actually a very young oil. It's basically a pre-oil and there are very large oil shale deposits in the world, the largest of which are in the United States, Jordan, China and Australia. The other type of unconventional oil is the so-called extra heavy oil or bitumen and these are actually very old oils. They're extremely viscous, they can have a texture almost like peanut butter and they just won't flow in the subsurface because of their viscosity. So it's necessary to heat them in situ in the ground, in order to get them to flow.

Interviewer: I'd like to maybe get back to some of these details of how this is done. Maybe give us a sense of how much oil we're talking about here. How much of this unconventional oil is there?

Vinegar: There's a huge amount. Just in Colorado, in the Green River oil shale, there's over one trillion barrels in place. To give you a sense of how large that is, that's enough to power the world until the middle part of the century. Around the world, if we add both the oil shale deposits and the bitumen and extra heavy oil, there's several trillion barrels of unconventionals. That's more than three times the amount of the world's remaining resources of conventional oil. So it's huge potential.

Interviewer: What are some of the challenges to getting at this oil?

Vinegar: In the past, for over a century, people have tried mining oil shale and treating it in surface retorts. These are large ovens that basically cook the rock after it's been mined. They cook it to a very high temperature so the oil is expelled very quickly. The problem is that the mining and surface retorting is very expensive. There's a lot of environmental difficulties with it. You wind up with a lot of waste rock, because, after you've mined it and you've heated it up, the rotten matrix has to be disposed of somewhere, so you get enormous mounds of waste rock build up on the surface and when it rains you get xxx coming off the spent rock, which carries contaminants. So it's undesirable from an environmental viewpoint. It also uses a large amount of water, a big negative in a lot of these dry environments. The other bad thing about it is that it heats the rock to very high temperatures so that the matrix actually decomposes and carbon dioxide is emitted. This is bad for global warming. So there are a lot of negatives to the surface mining and retorting operations for oil shale.

Interviewer: And as you've described some of these… the concepts are fairly simple. These are electrically powered heaters that are in the ground, slowly cooking the earth. There's also some refrigeration involved. Is that what's happening here? Tell me more about what's happening under the earth.

Vinegar: In oil shale, particularly in Colorado, it's very important that we keep water out of our heated pattern. So this has taken a lot of innovation to find a way to keep water out and to keep the oil that we make inside. Came up with the idea of building a frozen wall that completely surrounds the heated area and we have successfully piloted that and we're going to now larger demonstrations of that freeze wall technology. It's an example of innovative kind of thinking that you could actually have heaters in the ground, raising the temperature there to 300 centigrade, and at the same time you can literally freeze the wall, make a frozen barrier around the whole thing and not have the heat in the ground melt the frozen wall. So there's been a lot of innovative and unconventional thinking here and it's taken a long time to reach this stage. It's an example of why it's so necessary to be persistent. It's easy to get discouraged along the way when you're doing something that's this large in impact but yet so difficult. Simple to explain, but yet the heaters are a major development, the freeze wall is a major development, learning how to control the process in the subsurface also has taken many years. Basically, to me it shows an example of Shell's long-term thinking in this area and its belief that research and development will ultimately solve the problems.

Interviewer: You've been listening to Harold Vinegar, a chief scientist for Shell, on unlocking unconventional oil by warming the ground. Our thanks today to Shell, encouraging dialogue on the energy challenge. To subscribe to this and other free

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