letters

Efficiency and environmental effects in the oil sands of Alberta

One day this past March, I received two interesting pieces of mail: PHYSICS TODAY's March 2009 issue and the March/April issue of *Nature's Voice*, a publication of the Natural Resources Defense Council.

The PHYSICS TODAY issue contains an interesting article, "Physics in the Oil Sands of Alberta" (page 31).

On page 1 of *Nature's Voice* is an article entitled "America's Birds Face New Dangers This Spring," which highlights the potential danger to America's migrating bird populations from oil extraction in the great northern forest of Canada. According to the article, the forest is "one of the planet's largest bird nurseries" and is suffering the onslaught of "major oil companies seeking to extract petroleum from its sandy soils for export to the United States."

The loss of habitat will affect "more than half of America's migratory birds," according to the article, and "some 8000 to 100 000 birds of various species die each year in ponds containing toxic mining waste."

That situation affects more than bird populations. The article states that "tar sands mining is also Canada's fastest growing source of global warming pollution."

It seems to me this is another case in which physicists, in choosing a particular project to work on, should consider the consequences to the natural environment and to mankind.

Lloyd O. Timblin Jr
(timblinl@mindspring.com)
Boulder, Colorado

Rather than processing oil sands as a petroleum deposit, would it be more cost-effective to manage them as mushy coal? That is, instead of dealing with the processing and refining issues described in the article by Murray Gray, Zhenghe Xu, and Jacob Masliyah, why not build an on-site power plant to burn the crushed oil-sands ore and transport and then sell the resulting electricity? As an added benefit, the waste would probably be a coarse clinker, rather than the water-rich sludge now in the tailings ponds.

Gary Stiles
(gkstiles@sbcglobal.net)
Orange, California

"Physics in the Oil Sands of Alberta" is an educational summary article. The authors' final sentence reads, "Only through understanding the science of bitumen, sand, clay, and water interactions can we effectively and responsibly recover that Canadian resource." The authors should have completed that sentence with "and commit the world to dangerously high concentrations of atmospheric CO_2."

Ezra Wood
(ezrawood@aerodyne.com)
Aerodyne Research Inc
Billerica, Massachusetts

Gray, Xu, and Masliyah reply: In our article we presented both the underlying science of the operations and a summary of the environmental issues that the oil-sands industry faces. Mining and processing of the oil sands results in greenhouse gas emissions "from well to wheels"—that is, from production through to the vehicle tailpipe—of around 108 grams of carbon dioxide emissions per megajoule of gasoline, compared with 95–105 g CO_2e/MJ for a range of conventional crude oils imported into the US.[1] Due to the energy required to heat the underground formations, the well-to-wheels emissions from an in situ process are higher: approximately 115 g CO_2e/MJ for both California heavy oil and for bitumen sent from the oil sands to US refineries. In comparison, the highest-emission technology is coal conversion to liquid fuels, at approximately 200 g CO_2e/MJ. Used on a large scale in South Africa, coal-conversion technology is also under development in China and is proposed for use in the US.

Any feasible scenario for growth in production of renewable sources of transportation fuels, in combination with conservation measures, will still require use of petroleum for many years. In our opinion, oil-sands processing is an essential component of a secure energy supply for North America. The oil sands are valuable for the production of transportation fuels, not for combustion for their energy content alone. Natural gas is a much more favorable alternative for generating electricity.

The issue of CO_2 emissions from any use of petroleum is very real, but several environmental groups have targeted the oil-sands industry by combining incorrect information with extreme extrapolation to create alarming scenarios. The most egregious of those claims is the projected impact on migratory birds. By considering the total population of migratory birds crossing northern Alberta, the total area of oil-sands deposits, and unsupported estimates of bird deaths in the tailings ponds, they have projected Armageddon for migrating songbirds and waterfowl. As we wrote in our article, only a small fraction of the total oil-sands resource can be mined. The total area approved for mining is 1520 km^2, out of Alberta's 661 848 km^2 area; the approved area represents 0.04% of the Canadian boreal forest. In that zone, the current area of the tailings ponds is approximately 60 km^2. In

Letters and opinions are encouraged and should be sent by e-mail to ptletters@aip.org (using your surname as "Subject"), or by standard mail to Letters, PHYSICS TODAY, American Center for Physics, One Physics Ellipse, College Park, MD 20740-3842. Please include your name, affiliation, mailing address, e-mail address, and daytime phone number on your attachment or letter. You can also contact us online at http://www.physicstoday.org/pt/contactus.jsp. We reserve the right to edit submissions.