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Beyond Shale: Are Methane Hydrates the Next Energy Source?

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The energy of the future could lie buried deep underneath the world's oceans and the Arctic permafrost. Methane hydrates, also known as "flammable ice,"� are vast reservoirs of natural gas trapped in ice-like crystals and hold out the potential to alter trade flows and reshape the geopolitics of energy. As the name suggests, methane hydrates consist of a methane molecule surrounded by a cage of interlocking water molecules. It is effectively an ice that occurs naturally in subsurface deposits in freezing temperature and high pressure conditions. When melted or exposed to pressures and temperatures outside those where the ice is stable, the solid crystalline lattice turns into liquid water, and the enclosed methane molecules are released as gas. Until recently, methane hydrates had never been tapped as a source of energy to meet increasing global demands. It has been generally considered that other sources of fossil fuels - notably conventional oil and gas (and more recently shale) - have been easier and cheaper to access. But in March 2013, Japan became the first country to successfully flow gas from methane hydrate deposits under the Pacific Ocean. Whilst methane hydrate resources may appear to be an enormous boon to energy-starved nations like Japan, it is widely considered that developing methane hydrates could have a significantly detrimental effect on the climate if it results in the escape of methane into the atmosphere. The potential rewards of releasing methane from gas hydrate fields must therefore be balanced with the risks. **The environment** Methane is a greenhouse gas and is considered to be 25 times more potent than carbon dioxide in trapping solar radiation in the atmosphere. As a result, there is great concern over any uncontrolled release of methane from hydrate formations. Methane hydrates are particularly fragile: the sediment in which they are located is inherently unstable once removed from the high pressures and low temperatures of the deep sea. Any dissociation can result in leakage and extraction is, at present, inefficient. However, clean-burning gas from hydrates may actually help to displace coal consumption in countries such as China and India, just as cheap shale gas is now driving coal out of the American electricity markets. This scenario could potentially yield climate benefits and cleaner air "“ assuming the displaced coal stays in the ground. Nevertheless, even modest leakage rates could nix any potential climate benefit of burning hydrates instead of coal. **Technology** Despite Japan's ground-breaking success in producing gas from undersea hydrates, there is still much work to be done to develop a commercially profitable set of technologies for efficient methane hydrate extraction. The cost of developing any new energy is high and methane hydrates are no different. In the U.S., the current cost of methane hydrate is estimated to be $30 to $50 per million British thermal units (**BTUs**), compared to approximately $4 per million BTUs for natural gas. Yielding commercial quantities of natural gas from hydrates at an affordable price therefore presents numerous challenges. Those challenges stem in part from the difficult environments in which hydrates are found and where would-be hydrate producers must drill: the frozen expanses of the Arctic and the deep sea abyss. **The future** Methane hydrates may represent the world's largest source of untapped fossil energy and are believed to be a larger hydrocarbon resource than all of the world's oil, natural gas and coal resources combined. Of course, just as with shale gas (and conventional hydrocarbons, for that matter), not all of this potential energy resource will prove technically recoverable. Yet if the technology to commercially extract gas from hydrates is developed, the potential implications for global energy markets are staggering.