Tapping into a cool fuel of the future: International team plans $45−million expedition to the Canadian Arctic to explore ways of harvesting gas hydrates

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An international team plans to head to the Canadian Arctic this winter to tap into a tantalizing new source of energy thought to exceed all the oil, conventional gas and coal reserves in the world.

The $45−million project, funded largely by the Japanese, will explore ways to harvest the frozen fuel known as gas hydrates, which look like ice but burn with a flame when ignited. The hydrates, found in vast quantities in permafrost and under the world's oceans, trap and concentrate methane gas in tiny molecular crystals or cages.

The two−year project will build on earlier research done on the edge of the Beaufort Sea that showed the gas could be drawn up to the surface, at least in small amounts.

The multibillion−dollar question is whether hydrates can be economically produced, say the researchers, who will work at the research site, known as Mallik, on the northern edge of the Mackenzie Delta.

In 2002, the researchers pumped hot water down a 1,200−metre well at Mallik that melted the gas hydrates in the vicinity. Enough gas escaped up the well to fuel a flame that lit up the frigid landscape and demonstrated for the first time the gas could be released.

The upcoming project will also tap into growing expertise in northern communities.

"We're breaking new ground with these partnerships," says Andrew Applejohn, director of the Aurora Research Institute in Inuvik, which will be overseeing the drilling operations.

The project received key environmental approval in mid−September and drilling is expected to start in January.

Mallik is so remote it can only be reached in winter by ice road or helicopter. But the hydrates, a kilometre underground, are much more accessible than those under the world's oceans.

"It's the most concentrated and well−described site in the world," says Scott Dallimore, a gas hydrate expert at Natural Resources Canada and one of the lead investigators.

High pressure and cold temperatures are needed to trigger formation of the lattice cages made of water molecules that trap the methane gas. The methane is produced as buried organic material rots and the gas percolates towards the surface until conditions are right to form hydrates in and under permafrost.

In the oceans, degrading organic matter on the seafloor generates methane that becomes trapped, as hydrates, because of the immense pressures underwater. Canadian scientists made international headlines in 2002 when they found car−sized chunks of hydrates sticking out of the seafloor off the B.C. coast in waters almost a kilometre deep.

Hydrates have long intrigued and worried scientists, who fear they might release large amounts of methane, a potent greenhouse gas, into the atmosphere as the climate warms. But hydrates also promise to supply gas that burns much cleaner than coal or oil. One cubic metre of hydrates expands to 164 cubic metres of methane gas at room temperature and pressure.

It's been estimated twice as much energy is stored as gas hydrates than as all other hydrocarbon sources combined. One study pegged Canada's hydrate deposits at anywhere from 1,500 to 25,000 trillion cubic feet. The low estimate is enough gas to supply Canada's energy needs for a couple of hundred years −− if it could be recovered.

Dallimore cautions the estimates "do not speak to the reality, or the practicality" of recovering the gas. But the upcoming project should show its feasibility.

About 70 engineers, researchers and drillers will spend almost a month at Mallik this winter, drilling down 1,300 metres to test techniques to depressurize hydrates. It's hoped the gas will be liberated and flow to the well as the pressure drops. The team will return for three months in the winter of 2008 for further tests.

Dallimore and his Canadian colleagues are providing expertise and support, but their partners at Japan Oil, Gas and Metals National Corporation (JOGMEC) are paying most of the bill. NRCan is providing $2 million in direct funding for the project.

Kenichi Yokoi, leader of the JOGMEC's research team, declined to comment on Canada's financial contribution. But he said in an interview the Japanese team values its "good relations" with NRCan scientists and is keen to build on work done at Mallik in 1998 and 2002.

Japan, which imports most of its fuel, has huge stores of offshore gas hydrates and has made it a priority to see if they can be exploited. The team has been exploring the hydrates in Japanese waters from research ships. But Mallik has the advantage of providing a solid platform −− permafrost −− to work from.

Dallimore says all data from the upcoming project will be made public after two years. The team will also explore the environmental issues associated with hydrate production. "These will obviously have to be carefully addressed before commercial extraction takes place," he says.