StarCore Nuclear - Response to a Unique Challenge

The provision of clean energy at remote off-grid communities in the far North of Canada - above the 60th parallel - is a difficult challenge; with no grid connectivity the options are limited to some form of carbon-based fuel shipped to the site or the use of “renewables” - wind, solar, or hydro-electric power. It might seem that this “renewable power” would be ideal for these communities, but there is always the problem of the reserve power need to support the community needs when the renewable power fails. In the past this has always been provided by diesel or natural gas, but in the face of global warming this is not an attractive - or morally acceptable - long-term solution. StarCore Nuclear is a Canadian start-up nuclear power company with the specific goal of providing clean power, potable water and thermal energy to these remote communities.

Our design is for a small scale plant (Small Modular Reactor, SMR) that will fulfill local energy needs without requiring an extended power transmission infrastructure; that can be certified as a design and constructed inexpensively and in multiples on an assembly line, then simply assembled on site; that is designed to be fully automatic in operation and completely fail safe; that provides clean power, safe water, and thermal energy as standard outputs; that will be leased to operators instead of requiring local funding; and controlled (from a use/lease compliance viewpoint) by StarCore through a worldwide wireless fail-safe satellite network.

Our plant is a High Temperature Gas Reactor (HTGR) based on the Pebble Bed Modular (PBMR) reactor design originally developed in Germany in the 1960’s; this design has a very steep negative thermal gradient that causes the reaction to fall as temperature increases, thereby automatically driving the plant into a quiescent state if energy transfer systems fail. We have modified the design to simplify operation and added additional automatic fail-safe control elements to allow the plants to be pre-fueled and shipped in the quiescent state. Our design is a new class with a static bed and modified fuel packaging which allows us to optimize the core design for both improved thermal stability and increased nuclear efficiency.

At the site, the nuclear reactors are installed 57 metres underground in a double-walled stainless steel containment structure with passive thermal management of heat output, and with double-walled high performance concrete silos extending to the surface. The plant uses a three-stage energy transfer process from helium to nitrogen, and then from nitrogen to a standard air-breathing gas turbine to generate electricity. This three stage process allows us to prevent helium migration at the first stage heat exchanger by balancing pressure across this interface; in addition we have designed a passive fractional scrubber in the first stage system to remove any radioactive trace elements. Helium gas is inert and does not become radioactive in use, so that even venting all the first stage gas to atmosphere would not cause any radiation leakage, and a total loss of first stage integrity would only cause the reactor to automatically shut down in a completely safe condition from which it could be recovered to normal operation when the gas is recharged. The reactor is designed to operate in only two fully automatic and inherently safe states; Shut-Down and Load Following, and requires no day-to-day control. Although we expect to have local monitoring personnel at the sites for a considerable period,

the reactors are designed to be fully automatic with operational data and keep-alive signals transmitted by satellite to the StarCore Nuclear control center; the only local controllers will be those required to determine electrical and thermal output and distribution.

Inherently safe. Passively secure. Totally green. With two StarCore Reactors installed 57 metres (190 feet) underground in double-walled steel and high performance concrete silos that provide third and fourth level containment and security, the site is completely accessible to the public with no other overt security fences or guards. A single StarCore plant provides 20 MWe of load-following electricity, potable water and 12 MWt energy for use in other secondary processes.

Safe power and potable water from clean energy, produced by a plant that is designed to blend into the local environment and on a site designed to be integrated into community activities.

We are StarCore, and we have a vision.