Dual use of future natural gas pipeline rights-of-way for the transport of electricity via HTSC cables.

It appears likely that "clean" fossil fuels, exemplified by natural gas, given their current global abundance and accessibility, will continue to be exploited for at least the next two decades. We discuss a scenario whereby future natural gas/petroleum pipeline deployment provides an opportunity for creating a common right-of-way to transport both chemical and electrical energy, the latter via high capacity HTSC dc cables. Given the emergence of highly-Carnot efficient combined-cycle-gas-turbine (CCGT) generation technology, a significant portion of the natural gas delivered, perhaps as much as 40% or more, will be combusted to produce electricity. It would be useful to contemplate generating this electricity "in bulk" at the gas field "well head," taking into account the savings wrought by transmitting a lower volume fraction of gas with reduced frictional and pumping losses, and also economies of scale by concentrating CO_2 capture and reprocessing at a single site, rather than at a multitude of gas delivery points.

We examine two proposed North American projects as potential "ePipeline" candidates, 1) a 1220 km natural gas pipeline to run from gas fields located on the Mackenzie River delta on the Artic shore of the Northwest Territories south to a distribution infrastructure located in central Alberta, with a delivery capacity of 18 GW-thermal, and 2) an increased capacity build-out of the existing Keystone pipeline, dubbed "Keystone XL," to convey processed tar sand petroleum from Hardisty, Alberta, Canada, 3500 km southward to Houston, Texas. Although the pipeline itself is designed for oil transport, there are large untapped gas shale fields near Hardisty that could be exploited for local CCGT electricity generation subsequently co-transmitted within the Keystone XL right-of-way. In each case we will configure and parameterize the engineering economics appropriate to co-locating a 3 GW HTSC dc cable.

Lastly, we will suggest several European scenarios analogous to these two North American possibilities and briefly touch on combining liquid natural gas (LNG) and HTSC cryogenics, and eventually replacing well-head gas generation on depletion of the methane reserves with environmentally respectful nuclear fusion power to produce hydrogen and electricity for delivery over the now-existing ePipeline delivery infrastructure [1].

[1] P.M. Grant, "Cryo-Delivery Systems for the Co-Transmission of Chemical and Electrical Power," AIP Conf. Proc. 823, 291 (2006); doi: 10.1063/1.2202428 .