In the last two decades, it has become apparent that active galactic nuclei (AGN) play a vital role in the formation and evolution of galaxies, galaxy groups, and galaxy clusters. In broad terms, the galaxy formation paradigm which includes AGN feedback is successful in explaining the bulk properties of large-scale structure, specifically the thermal properties of the intracluster medium (ICM) in galaxy clusters and the intragroup medium (IGM) in galaxy groups. However, our understanding of the origins and influence of non-thermal ICM/IGM components is incomplete, primarily because the observational facilities needed for detailed studies of non-thermal emission have been unavailable. But, with LOFAR being commissioned, and hard X-ray observatories like Simbol-X and NuStar in-development, detailed investigation of ICM/IGM magnetic fields & MHD processes, diffuse large-scale radio halos, and the cosmic ray content of the ICM/IGM can be undertaken. Furthering our understanding of non-thermal components will also reveal additional connections between host environments and the AGN feedback loop. I am proposing to undertake studies of these non-thermal components using the rich X-ray and radio datasets from the current and future generation of facilities accessible through the NRL.