DEVELOPMENT OF A REINFORCED CONCRETE FOUNDATION SYSTEM FOR RENEWABLE ENERGY STORAGE USING COMPRESSED AIR TECHNOLOGY

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Introduction. The utilization of renewable energy leads to challenges of efficient energy generation, reliable energy storage and economic energy transportation. One of them is caused by the intermittent nature of renewable energy, which requires efficient methods for energy storage matching the generation of renewable energy with customer demands. Thus this project is to develop a reliable, safe and economic renewable energy storage media utilizing one of building structural components: a reinforced concrete (RC) foundation system. The proposed RC foundation system, in addition used for transferring structure loads into soils or rocks underground, will be configured to store renewable energy generated from solar panels or wind mills attached to building structures through compressed air energy storage (CAES) technology[1] (Fig.1).

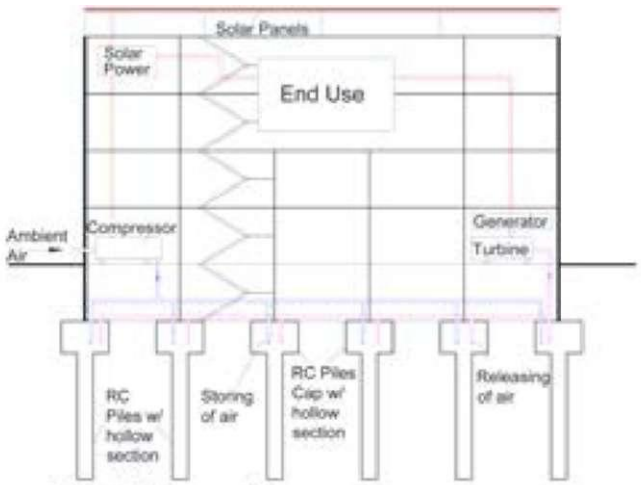

Fig. 1. Renewable energy storage system.

Materials and Methods. The research aims to produce a reliable RC foundation system for both structural load bearing and sustainable energy storage via CAES. This goal will be achieved by experimental (large scale tests) and analytical (finite element analysis) integrated research methods. In recognizing that for civil infrastructure, innovative research that is not anchored in the practical realities of the construction industry is rarely adopted, the research will move along two slightly staggered, parallel yet integrated tracks: one to develop knowledge and one to use that knowledge toward application. These tracks will conclude with in dissemination of the research findings for technology transfer leading to the potential for implementation. The first track is to develop general knowledge for static and dynamic response of structural foundations and surrounding soils subjected to varying high air pressure. The second track involves development of candidate RC foundation systems via literature search, large scale field tests and knowledge developed in track one.

Conclusions. The final product of the proposed research is a reliable and cost-effective RC foundation system for structural loading transfer and sustainable energy storage. The proposed project will deliver design methodology and candidate configurations for the RC foundation system. The proposed RC foundation system, as the major research product, can be incorporated as an important component into next generation CO_2 free building structures to increase the effectiveness of the use of sustainable energy.

References.

1. Zhang, L., Ahmari, S., Sternberg, B., & Budhu, M. (2014). Feasibility Study of Compressed Air Energy Storage Using Steel Pipe Piles. Bridges, 10, 9780784412121-439.