Why it Matters

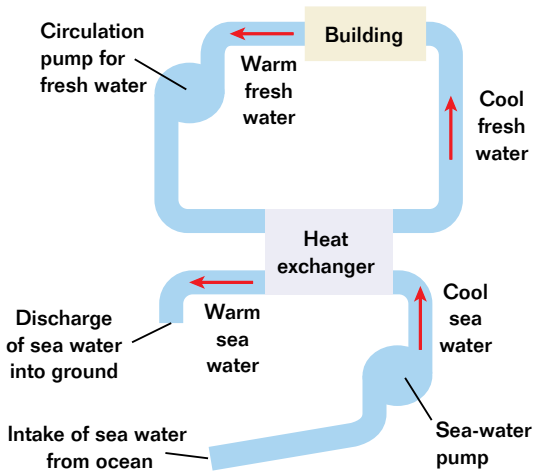
Deep-Sea Air Conditioning

Deep beneath the ocean, about half a mile down, sunlight barely penetrates the still waters. Scientists at Makai Ocean Engineering in Hawaii are now tapping into that pitch-dark region as a resource for air conditioning.

In tropical locations where buildings are cooled year-round, air-conditioning systems operate with cold water. Refrigeration systems cool the water, and pumps circulate it throughout the walls of a building, where the water absorbs heat from the rooms. Unfortunately, powering these compressors is neither cheap nor efficient.

Instead of cooling the water in their operating systems, the systems designed by Makai use frigid water from the ocean's depths. First, engineers install a pipeline that reaches deep into the ocean, where the water is nearly freezing. Then, powerful pumps on the shoreline move the water directly into a building's air-conditioning system. There, a system of heat exchangers uses the sea water to cool the fresh water in the air-conditioning system.

One complicating factor is that the water must also be returned to the ocean in a manner that will not disrupt the local ecosystem. It must be either piped to a depth of a few hundred feet, where its temperature is close to that of the ocean at that level, or poured into onshore pits, where it eventually seeps through the land and comes to an acceptable temperature by the time it reaches the ocean.



"This deep-sea air conditioning benefits the environment by operating with a renewable resource instead of freon," said Dr. Van Ryzin, the president of Makai. "Because the system eliminates the need for compressors, it uses only about 10 percent of the electricity of current methods, saving fossil fuels and a lot of money." However, deep-sea air-conditioning technology works only for buildings within a few kilometers of the shore and carries a hefty installation cost of several million dollars. For this reason, Dr. Van Ryzin thinks this type of system is most appropriate for large central air-conditioning systems, such as those necessary to cool resorts or large manufacturing plants, where the electricity savings can eventually make up for the installation costs. Under the right circumstances, air conditioning with sea water can be provided at one-third to one-half the cost of conventional air conditioning.