Regenerating antifreeze fluid by ice heat pump

- a new solution for developing large open air-source heat pump for district heating without coil freeze risk

With the green transition of the energy sector in Denmark, more wind and solar power will be used. This requires the use of new and better technologies in heating supply and a much wider application of large heat pumps driven by green electricity. Heat pump is an efficient device that moves heat from cold space to warm one just like a water pump moves water from low level to high level. In winter season, one can use heat pump to extract heat from cold outdoor air and move it to warm indoors for heating up indoor environment - the so-called air-source heat pump. The heat pump technology has been well developed; however, operation of air-source heat pump in the humid and cold Danish winter often encounters a severe freezing problem when extracting heat from outdoor air. The reason is that the moisture in outdoor air freezes into ice on the heat collector of air-source heat pump during operation and stop the heat transfer from air to the heat collector. For a large air-source heat pump system (e.g. a 1MW air-source heat pump heating system), around 10 to 20 tons of ice may be produced per day. Such amount of ice will completely block the operation of an air source heat pump or require a huge amount of energy being used for defrosting.

This project will develop a technology that can reject the ice in a controlled manner after extracting heat from outdoor air. The technology may lead to a new design of air-source heat pump that can operate smoothly throughout the whole winter with reduced power consumption compared to the existing air source heat pump technology.