CLAIMS:

1. A method of operating an engine having one or more cylinders each having a piston within the cylinder and each piston (18) having an expansion stroke and a return stroke and a top dead centre position and a bottom dead centre position and said engine employing a working fluid and a heat exchange fluid, comprising the steps of:

   I. introducing the heat exchange fluid during the return stroke of the engine;

   II. introducing the working fluid during the expansion stroke of the engine;

   III. causing the exhaust valve to be opened at or near bottom dead centre of the piston;

   IV. delivering the heat exchange fluid to the cylinder after an exhaust valve of the engine has been opened; and

   V. closing the exhaust valve before top dead centre to allow the working fluid to be compressed by the piston within the cylinder.

2. The method as claimed in claim 1 including the step of introducing heat exchange fluid into the cylinder no less than 5 degrees after opening the exhaust valve.

3. The method as claimed in claim 2 including the step of completing the closure of the exhaust valve between 340 and 358 degrees.

4. The method as claimed in claim 2 including the step of completing the closure of the exhaust valve between 345 and 350 degrees.

5. The method as claimed in claim 2 including the step of completing the closure of the exhaust valve between 350 and 355 degrees.

6. The method as claimed in claim 2 including the step of continuing heat exchange fluid introduction until after the exhaust valve is fully closed.

7. The method as claimed in claim 2 including the step of continuing heat exchange fluid introduction until after the exhaust valve is fully closed and in which heat exchange fluid introduction is maintained until between 2 and 10 degrees after the exhaust valve is fully closed.

8. The method as claimed in claim 2 including the step of continuing heat exchange fluid introduction until after the exhaust valve is fully closed and in which heat exchange fluid introduction is maintained until between 2 and 10 degrees after the exhaust valve is fully closed and in which the heat exchange fluid introduction is ceased no later than top dead centre.

9. The method as claimed in claim 2 and including the step of compressing any remaining working fluid within the cylinder between finally ceasing heat exchange fluid introduction and top dead centre.

10. The method as claimed in claim 1 including the step of introducing working fluid into the cylinder under pressure at or between 0 degrees and 60 degrees after top dead centre.

11. The method as claimed in claim 1 and including the step of controlling heat exchange fluid introduction to create a negative heat transfer upon injection.

12. An engine system, comprising:

i) A first storage tank, for storing working fluid;

ii) an engine having one or more cylinders each having a piston therein movable between a top dead centre position and a bottom dead centre (BDC) position and each cylinder having an inlet valve and an exhaust valve and;

iii) a first delivery system for delivering working fluid from the first storage tank and to the engine;

iv) a second storage tank for storing heat exchange fluid;

v) a second delivery system, for delivering heat exchange fluid from the second storage tank to the engine;

vi) a controller, operably connected to the first delivery system and the second delivery system and configured to cause delivery of heat exchange fluid to the cylinder during a return stroke of the one or more pistons and for closing the exhaust valve before top dead centre, to allow the working fluid to be compressed by the piston within the cylinder.

13. An engine system as claimed in claim 12, wherein said controller is configured for

introducing heat exchange fluid into the cylinder no less than 5 degrees after opening the exhaust valve.

14. An engine system as claimed in claim 13, wherein said controller is configured for completing the closure of the exhaust valve between 340 and 358 degrees.

15. An engine system as claimed in claim 13, wherein said controller is configured for completing the closure of the exhaust valve between 350 and 355 degrees.

16. An engine system as claimed in claim 12, wherein the controller is configured to maintain heat exchange fluid introduction until between 2 and 10 degrees after the exhaust valve is fully closed.

17. An engine system as claimed in claim 12, wherein the controller is configured to cease heat exchange fluid introduction no later than TDC.

18. An engine system as claimed in claim 12 including an injector for injecting working fluid into the cylinder under pressure at or between 0 degrees and 60 degrees after TDC.

19. An engine system as claimed in claim 12 , wherein said working fluid includes at least one of liquid nitrogen, liquid air, liquefied natural gas, carbon dioxide, oxygen, argon, compressed air, compressed nitrogen or compressed natural gas.

20. A method of operating an engine having a working chamber having an expansion motion and a return motion and said engine employing a working fluid and a heat exchange fluid, comprising the steps of: introducing the heat exchange fluid during the return motion of the working chamber; introducing the working fluid during the expansion motion of the working chamber; causing an exhaust of the working chamber to be opened at or near the point of maximum chamber volume; delivering the heat exchange fluid to the chamber after the exhaust has been opened; and closing the exhaust before the point of minimum chamber volume to allow the working fluid to be compressed within the working chamber.