What is claimed is:

1. A natural gas liquefaction system comprising:

a vapor-liquid separator configured to remove carbon dioxide in liquid state from natural gas containing carbon dioxide by compressing and cooling the natural gas containing carbon dioxide;

a precooling device configured to use the removed carbon dioxide to precool the natural gas containing carbon dioxide;

a natural gas liquefying unit configured to cool the natural gas from which the carbon dioxide has been removed, so as to produce liquefied natural gas (LNG); and

a natural gas supply pipeline for supplying the natural gas from which the carbon dioxide has been removed to the natural gas liquefying unit.

2. The natural gas liquefaction system according to claim 1, further comprising vaporizing means configured to vaporize the carbon dioxide removed by the vapor-liquid separator and supply the vaporized carbon dioxide to the precooling device.

3. The natural gas liquefaction system according to claim 1, wherein the precooling device is configured to use the removed carbon dioxide still in liquid state for the precooling.

4. The natural gas liquefaction system according to any one of claims 1 to 3, further comprising a carbon dioxide absorbing and removing device configured to further bring the natural gas from which the carbon dioxide has been removed by the vapor-liquid separator into contact with a carbon dioxide absorbing solution so as to further remove carbon dioxide from the natural gas.

5. A method for producing liquefied natural gas, comprising the steps of:

removing carbon dioxide in liquid state from natural gas containing carbon dioxide by compressing and cooling the natural gas containing carbon dioxide;

using the removed carbon dioxide to precool the natural gas containing carbon dioxide;

supplying the natural gas from which the carbon dioxide has been removed to a natural gas liquefying unit via a natural gas supply pipeline; and

cooling the natural gas from which the carbon dioxide has been removed, so as to produce liquefied natural gas (LNG) at the natural gas liquefying unit.

6. The method for producing liquefied natural gas according to claim 5, wherein the removed carbon dioxide is used in vaporized state or still in liquid state for precooling.

7. The method for producing liquefied natural gas according to claim 5 or 6, further comprising a step of further bringing the natural gas into contact with a carbon dioxide absorbing solution to further remove carbon dioxide from the natural gas after the step of removing the carbon dioxide in liquid state.