CLAIMS

1. A device (10, 110) for cooling natural boil-off gas for an energy production installation (12, 112), in particular on board a ship,

characterized in that it includes:

- a main tank (14, 114) for storing liquefied gas including a first natural boil-off gas outlet (45, 145),

- means (170 XXX) for taking up liquefied gas in said main tank and cooling that liquefied gas,

- a secondary tank (30, 130) for cooled liquefied gas configured to store liquefied gas cooled by said cooling means, and

- a first heat exchange circuit (40, 140) including an inlet connected to said first outlet of said main tank in order to circulate natural boil-off gas in said circuit, said first circuit being configured to cooperate with said secondary tank in order for said natural boil-off gas passing through said first circuit to be cooled by cooled liquefied gas stored in said secondary tank or coming from said secondary tank.

2. The device (10, 110) as claimed in the preceding claim, further including:

- a first separation drum (50, 150) an inlet of which is connected to an outlet of said first circuit (40, 140) to feed said first drum with cooled natural boil-off gas and with natural boil-off gas recondensed and forming cooled liquefied gas, said first drum including a first, natural boil-off gas outlet and a second, cooled liquefied gas outlet connected to said main tank in order to inject cooled liquefied gas into said main tank.

3. The device (10, 110) as claimed in any one of the preceding claims, including at least one first compressor (26, 126) an inlet of which is connected to said first natural boil-off gas outlet of said main tank (14, 114) and/or to said first natural boil-off gas outlet of said first drum (50, 150).

4. The device (10, 110) as claimed in any one of the preceding claims, in which said cooling means include a second heat exchange circuit (172) that is intended to cooperate by exchange of heat with liquefied gas in said secondary tank (30, 130) or coming from said secondary tank (30, 130), and in which a

cooling fluid circulates in order to cool said liquefied gas and to generate cooled liquefied gas.

5. The device (10, 110) as claimed in any one of claims 1 to 3, in which said cooling means include:

- a second drum (24) an inlet of which is connected to a first end of a first pipe (18, 118) a second end of which is intended to be immersed in the liquefied gas contained in said main tank (14, 114), said first pipe being adapted to feed said second drum with liquefied gas, and

- a second pipe (31) a first end of which is connected to a first cooled liquefied gas outlet of said second drum and a second end of which is connected to said secondary tank in order to feed said secondary tank (30, 130) with cooled liquefied gas.

6. The device (10, 100) as claimed in the preceding claim, including a first heat exchanger (60) a primary circuit (60a) of which has an inlet connected to a liquefied gas outlet of said main tank (14) and an outlet connected to an inlet of said secondary tank (30) in order to feed said secondary tank with liquefied gas, and a secondary circuit (60b) has an inlet connected to said first pipe (18) and an outlet connected to the inlet of said second drum (24).

7. The device (10, 110) as claimed in claim 5 or 6, including:

- a first pump (16a, 116a) connected to said second end of said first pipe (18, 118) and intended to be immersed in said liquefied gas contained in said main tank (14, 114) so as to force the circulation of liquefied gas through said first pipe from said main tank to said second drum (24), and

- a second pump (35) connected to said second pipe (31) so as to force the circulation of cooled liquefied gas from said second drum (24) to said secondary tank (30, 130).

8. The device (10, 110) as claimed in any one of claims 5 to 7, in which said first pipe (18, 118) includes evaporation means (19).

9. The device (10, 110) as claimed in any one of the preceding claims, including at least one second compressor (28, 128) an inlet of which is connected to said first natural boil-off gas outlet (45, 145) of said main tank (14,

114), said second compressor including an outlet connected to said inlet of said first circuit (40, 140).

10. The device (10, 110) as claimed in the preceding claim, when dependent on any one of claims 5 to 8, in which said inlet of said second compressor (28, 128) is further connected to a second gas outlet of said second drum (24) and/or to a second gas outlet of said first drum (50, 150).

11. The device (10, 110) as claimed in claim 9 or 10 when dependent on claim 3, in which said inlet of said second compressor (28) is connected to the outlet of said first compressor (26).

12. The device (10, 110) as claimed in any one of claims 9 to 11, in which said first or second compressor (26, 28, 126) includes an outlet adapted to supply fuel gas, in particular to said installation (12, 112).

13. The device (10, 110) as claimed in any one of claims 9 to 12, in which said inlet of said first circuit (40, 140) is connected to said outlet of said first or second compressor (26, 28, 126) by a primary circuit (42b, 142b) of a second heat exchanger (42, 142), said second heat exchanger including a secondary circuit (42a, 142a) an inlet of which is connected to said first natural boil-off gas outlet (45, 145) of said main tank (14, 114) and an outlet of which is connected to said inlet of said first or second compressor.

14. The device (10, 110) as claimed in any one of the preceding claims, in which said secondary tank (30, 130) is connected to a first end of a third cooled liquefied gas pipe (32, 132) a second end of which is connected to said main tank (14, 114), said third pipe being adapted to route at least some of said cooled liquefied gas from said secondary tank to said main tank.

15. The device (10, 110) as claimed in the preceding claim, in which said third pipe includes a dip tube (34, 134) intended to be immersed in the liquefied gas contained in said main tank (14, 114) and/or a spray manifold (22, 122) situated in said main tank in order to inject cooled liquefied gas into said main tank.

16. A ship, in particular for transporting liquefied gas, including at least one device (10, 110) as claimed in any one of the preceding claims.

17. A method for feeding fuel gas to an energy production installation (12, 112), in particular on board a ship, by means of a device (10, 110) as claimed in any one of claims 1 to 15, characterized in that it includes the surveillance of at least one parameter of consumption of gas by said installation, and

- if the value of said parameter is above a predetermined threshold, a step of preparing and storing cooled liquefied gas, for example in said secondary tank,
- if the value of said parameter is below a predetermined threshold, a step of recondensing natural boil-off gas produced in excess in said main tank.

18. The method as claimed in the preceding claim, in which cooled liquefied gas is prepared if the production of natural boil-off gas is insufficient to satisfy the gas consumption of said installation.

19. The method as claimed in the preceding claim, in which liquefied gas is cooled by taking up, expanding and separating liquefied gas phases contained in said main tank.

20. The method as claimed in any one of claims 17 to 19, in which said cooled liquefied gas is stored in the main tank in order to condense natural boil-off gas in that tank, in particular if the available quantity of natural boil-off gas in that tank is greater than the requirement of said installation.