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CPC **F25J 1/0022** (2013.01)(72) Inventor: **Solomon Aladja FAKA**, Salter Point
(AU)(57) **ABSTRACT**

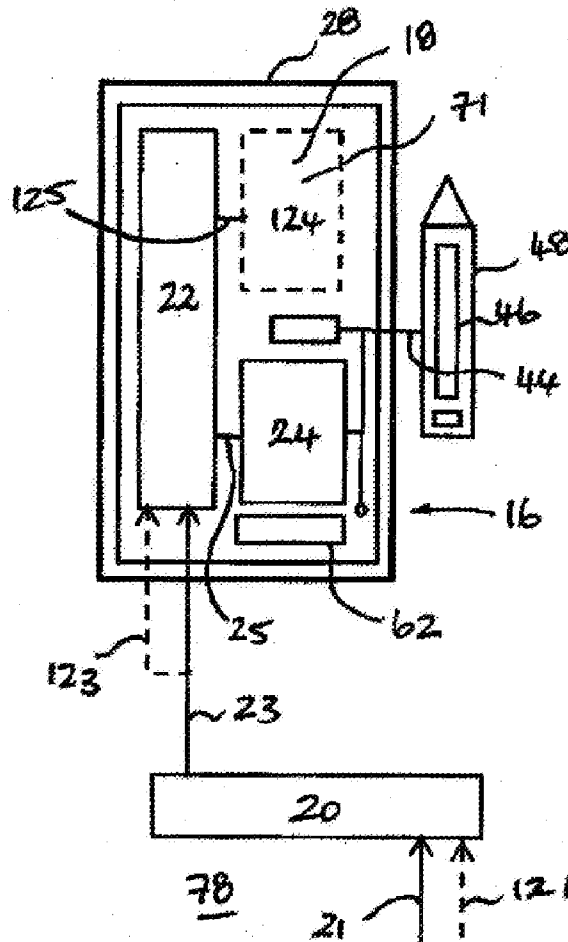
An LNG processing plant positioned at a processing location adjacent to a body of water is described. The LNG processing plant includes A) a first phase LNG processing plant for processing an initial plant capacity of LNG, the first phase LNG processing plant including a plurality of first phase facilities, each first phase facility provided with plant equipment related to a pre-determined function associated with the processing of LNG, wherein one or more of the plurality of first phase facilities is arranged on a deck of a structure wherein the deck is arranged above the level of the water at a selected offshore or near-shore location; and, B) one or more second phase facilities provided on the deck of the structure to provide a second phase LNG processing plant, said second phase LNG processing plant having a maximum plant capacity that is higher than the initial plant capacity.

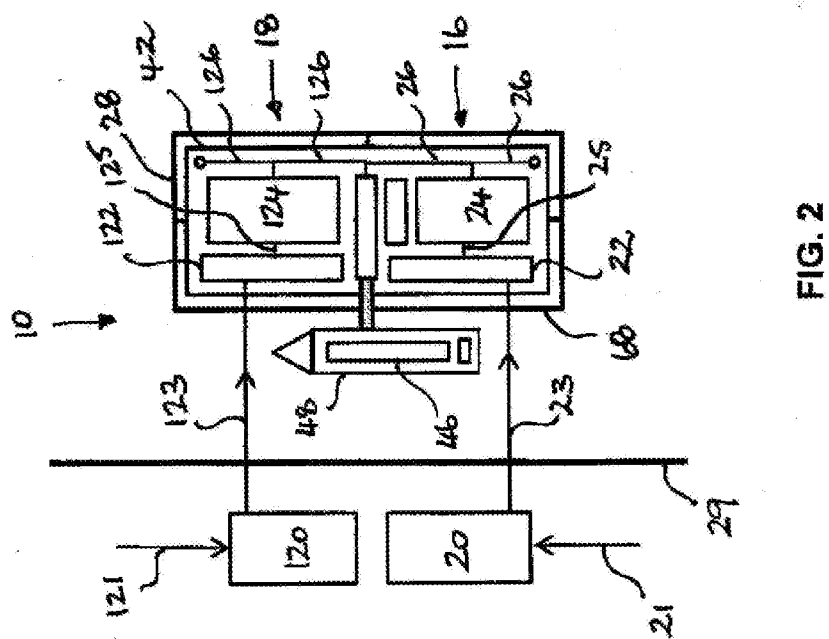
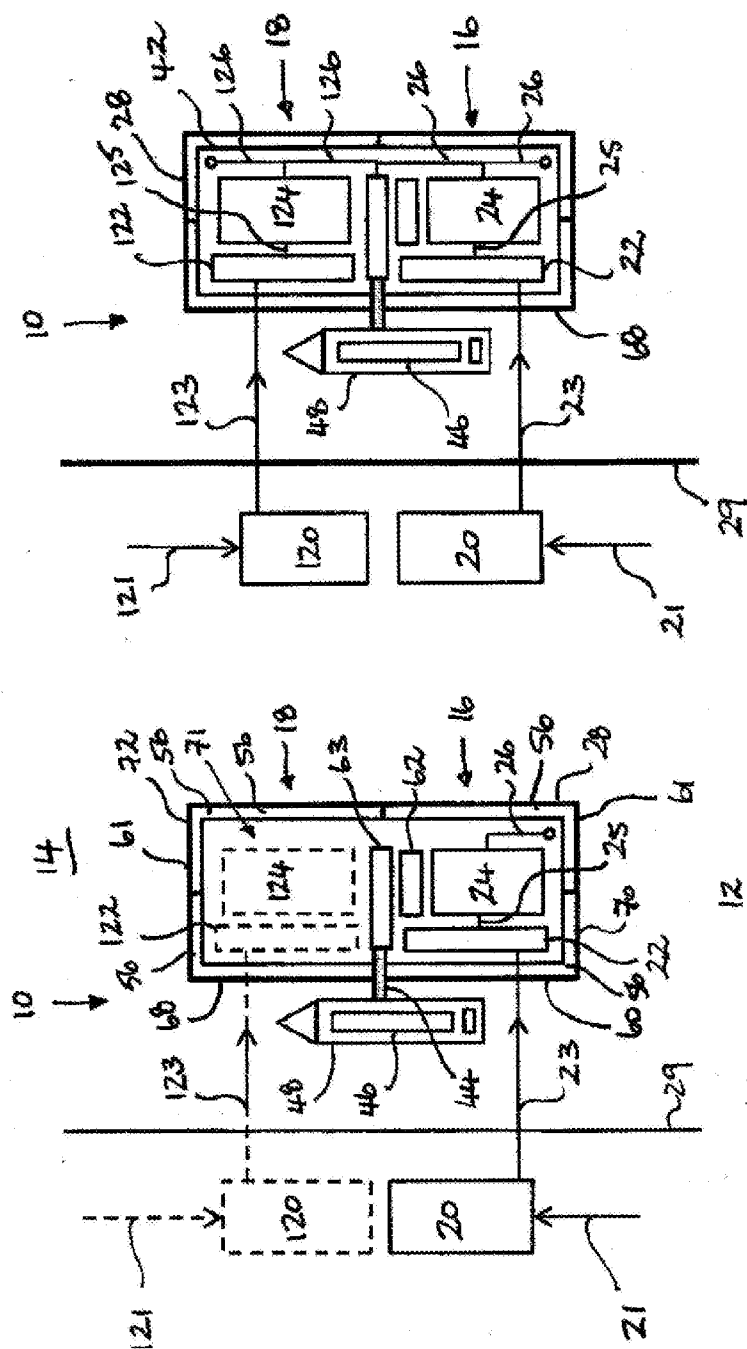
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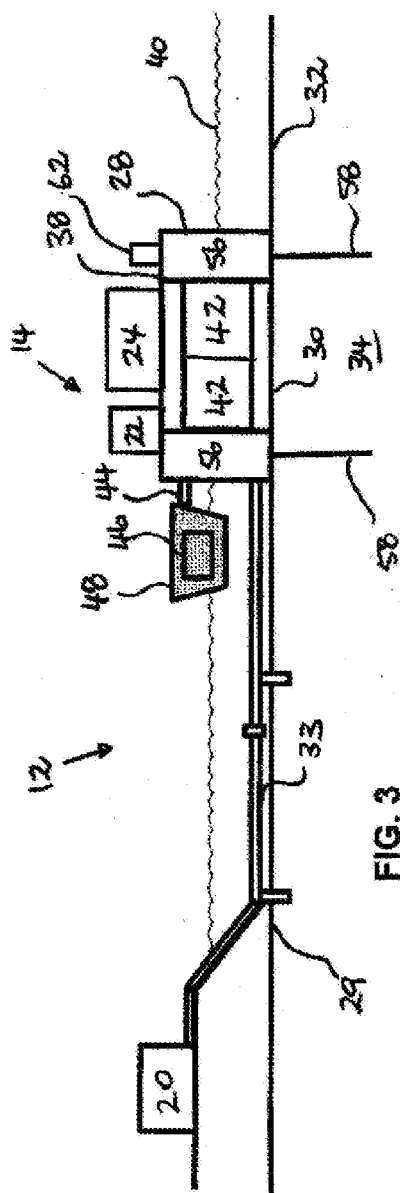


Fig. 3

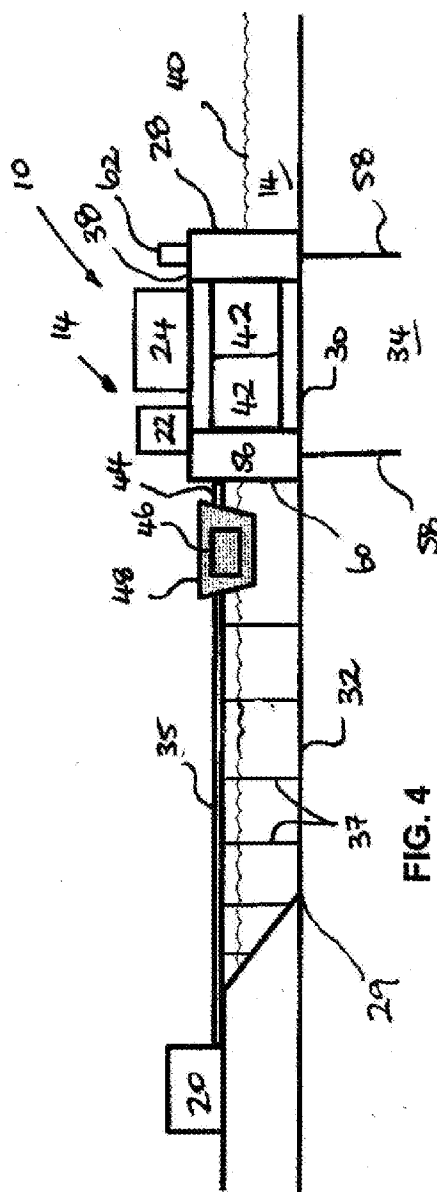


Fig. 4

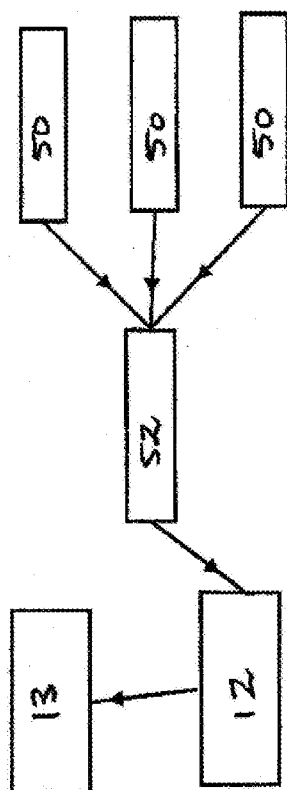
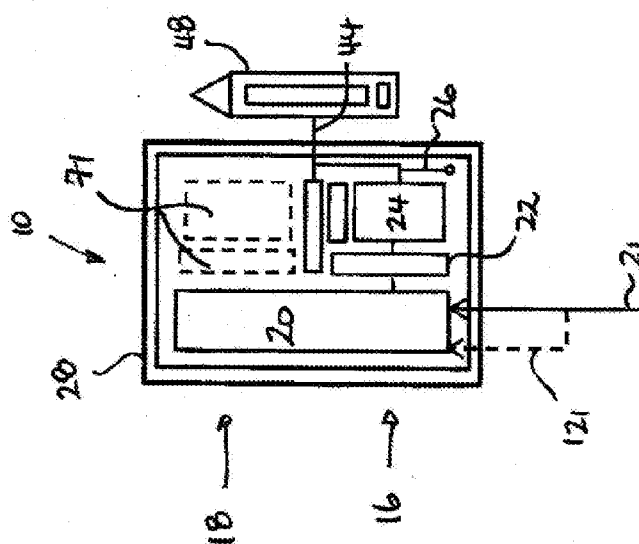
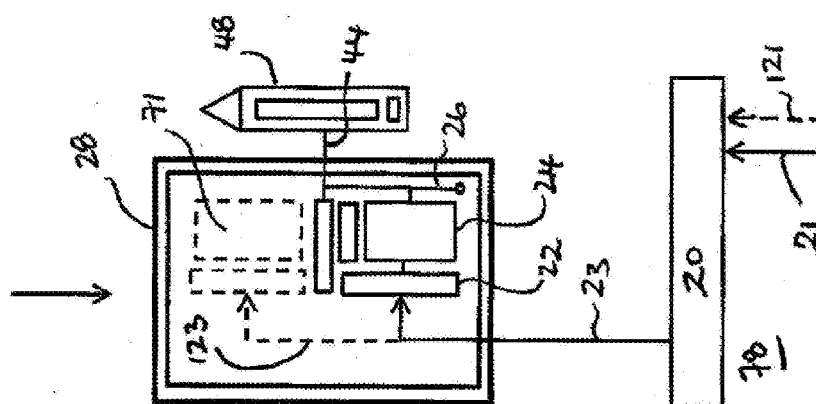
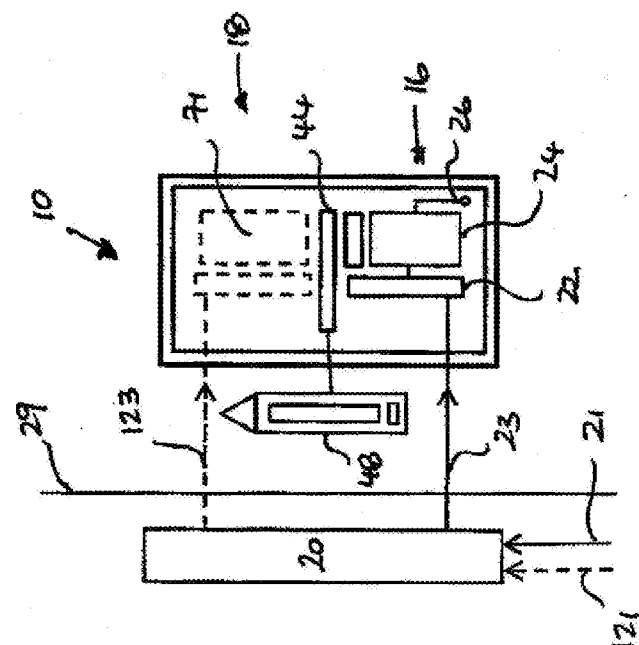
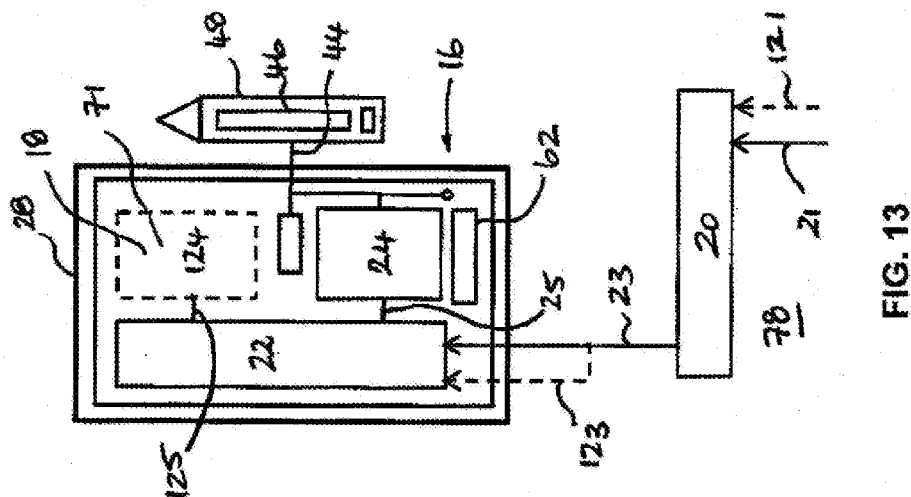
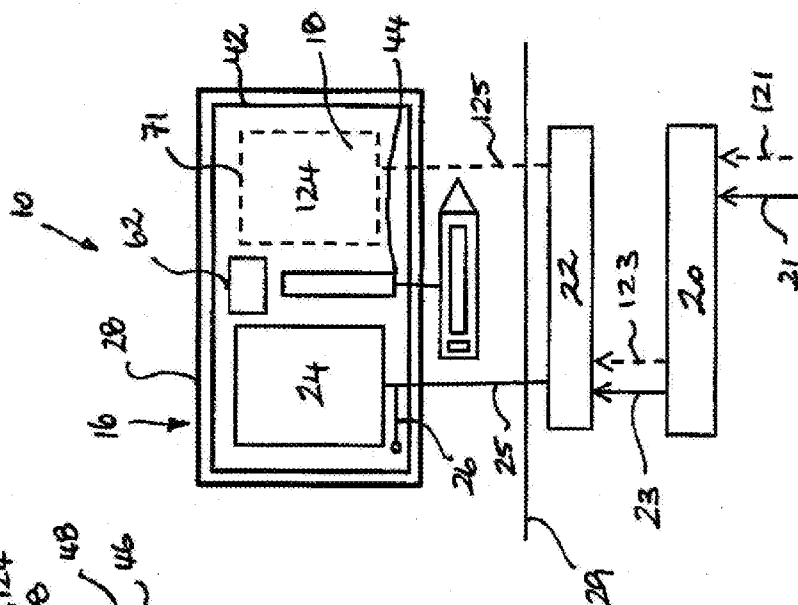
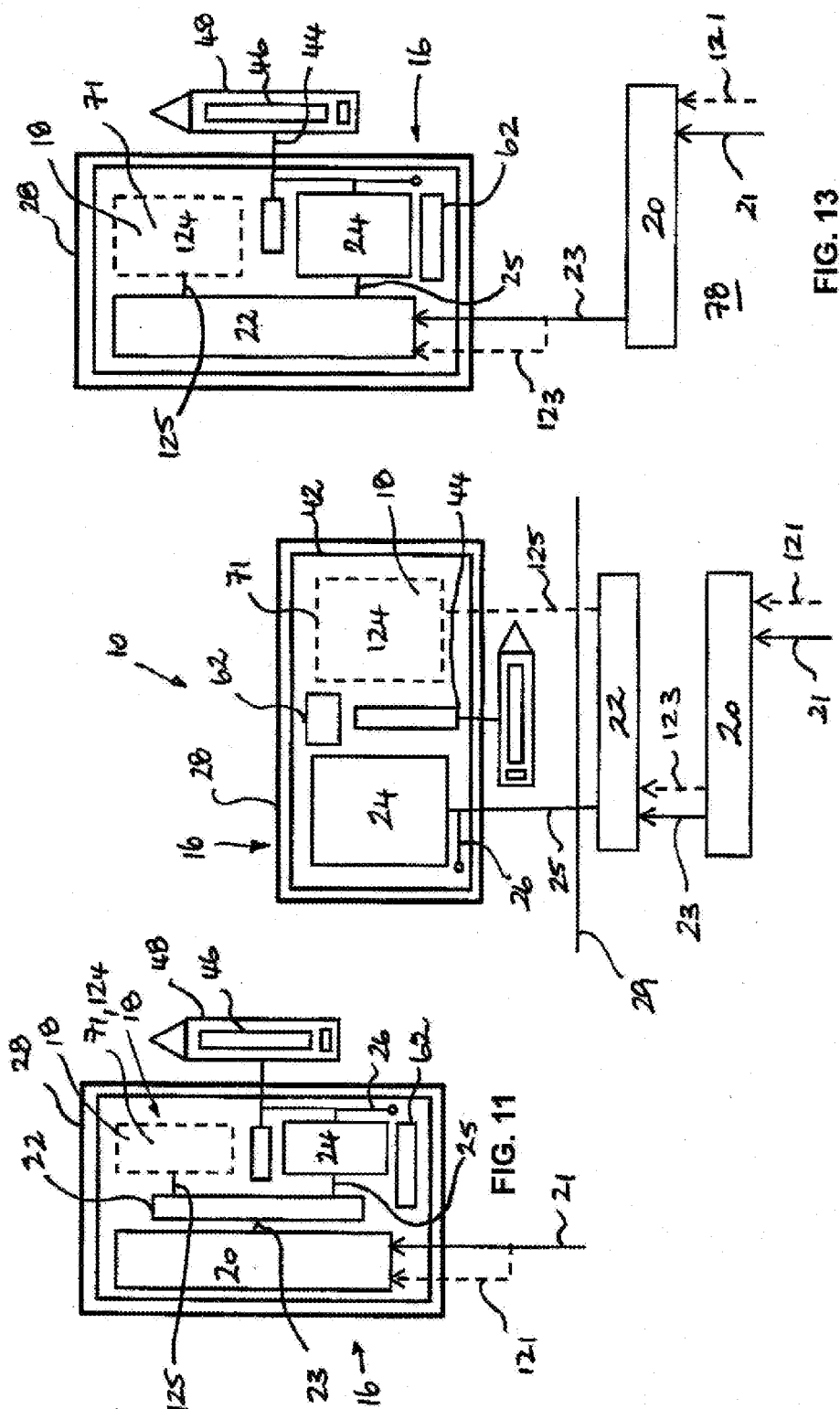


FIG. 5





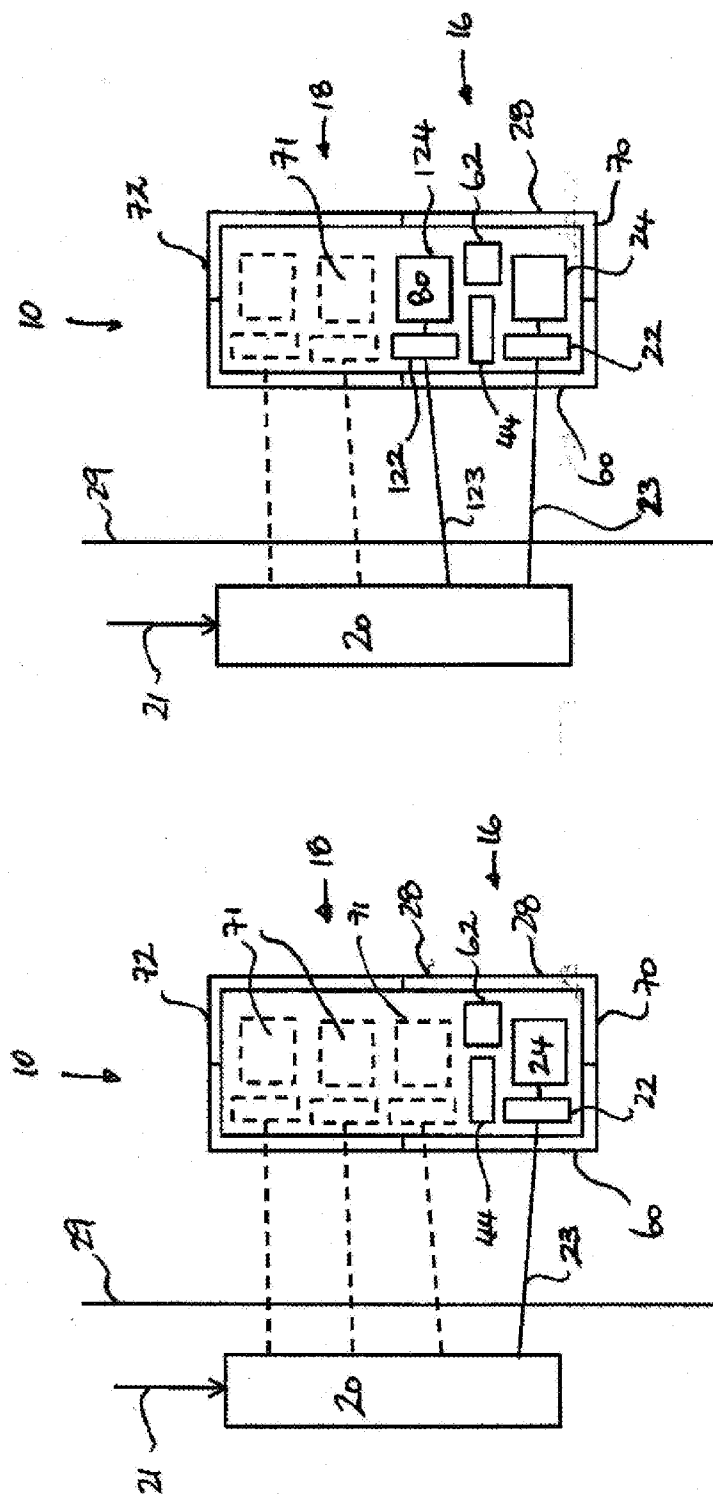


FIG. 15

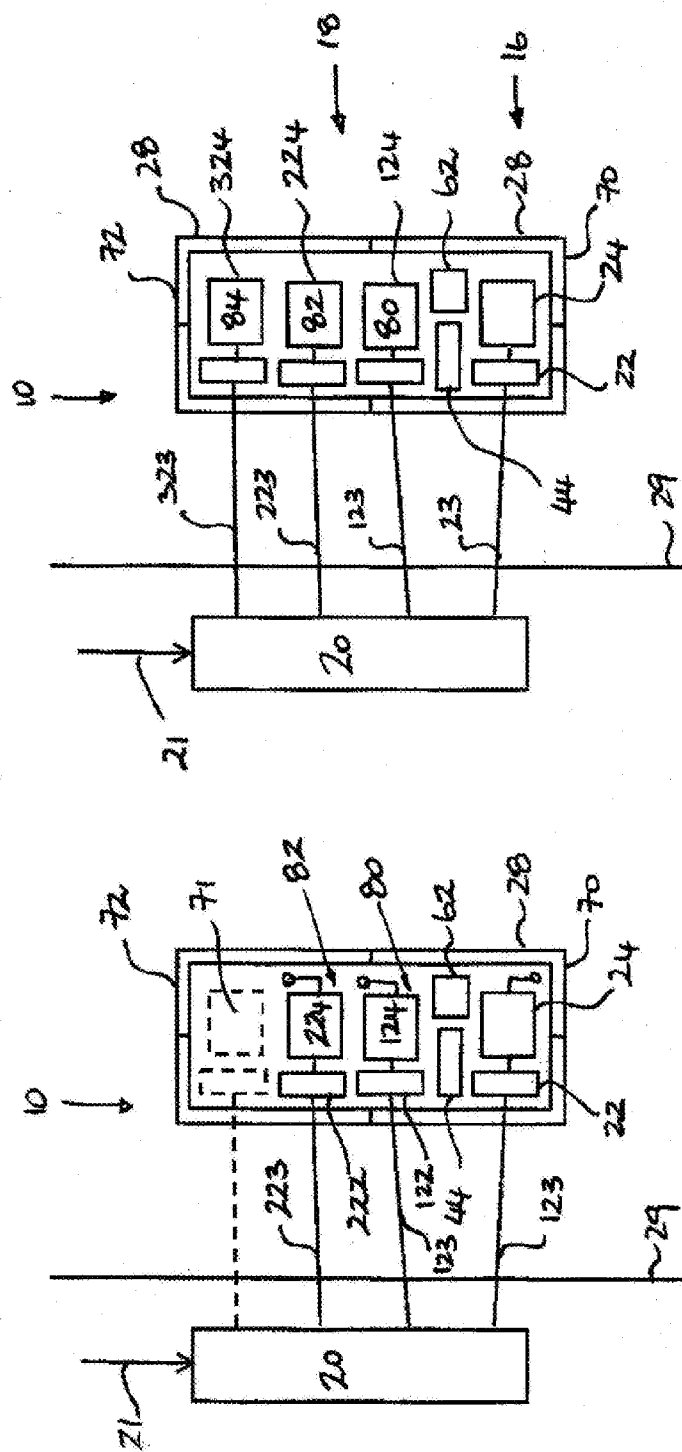


FIG. 16

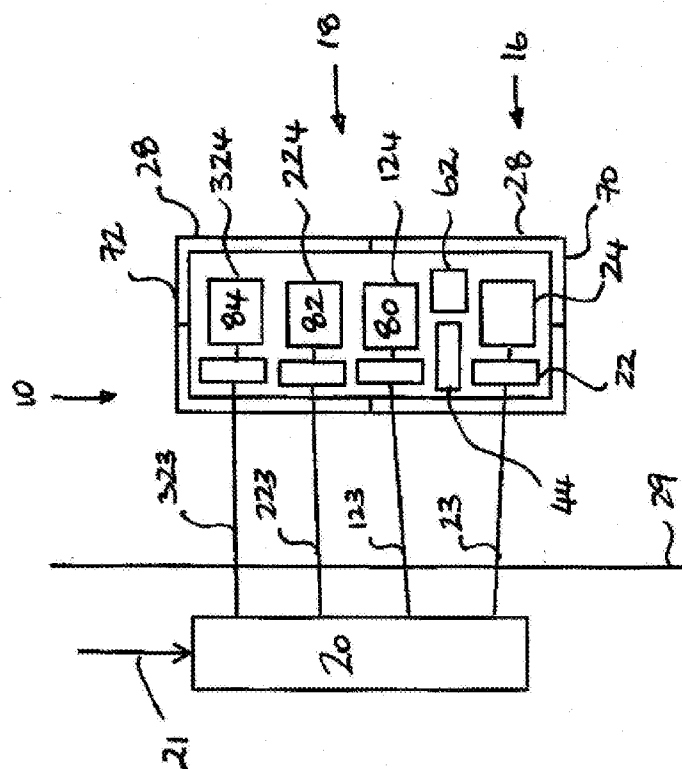


FIG. 17

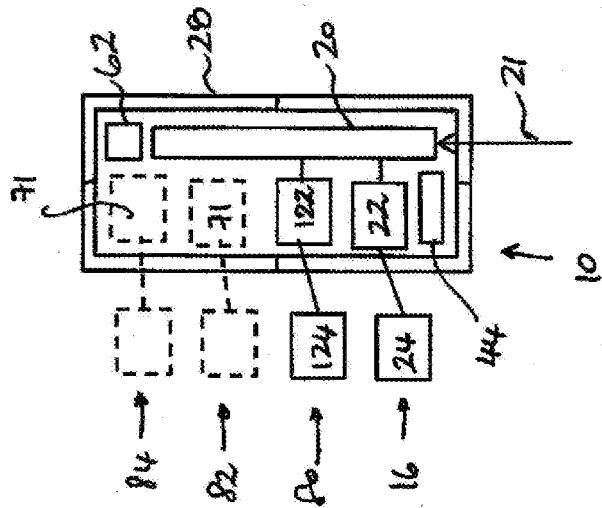


FIG. 19

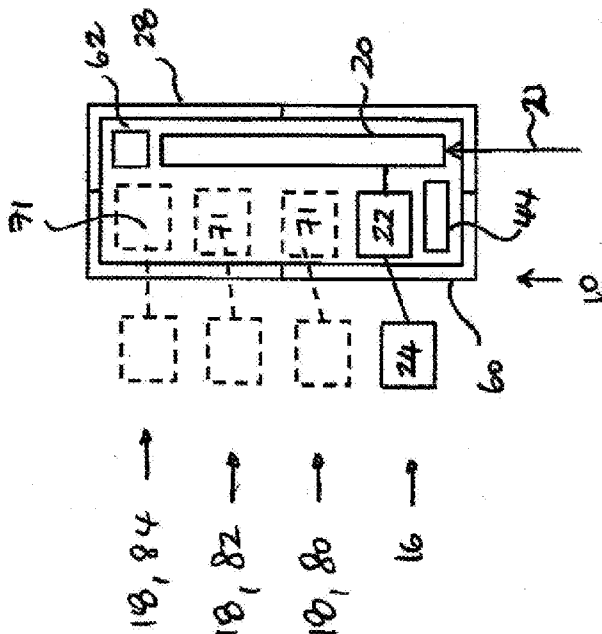


FIG. 18

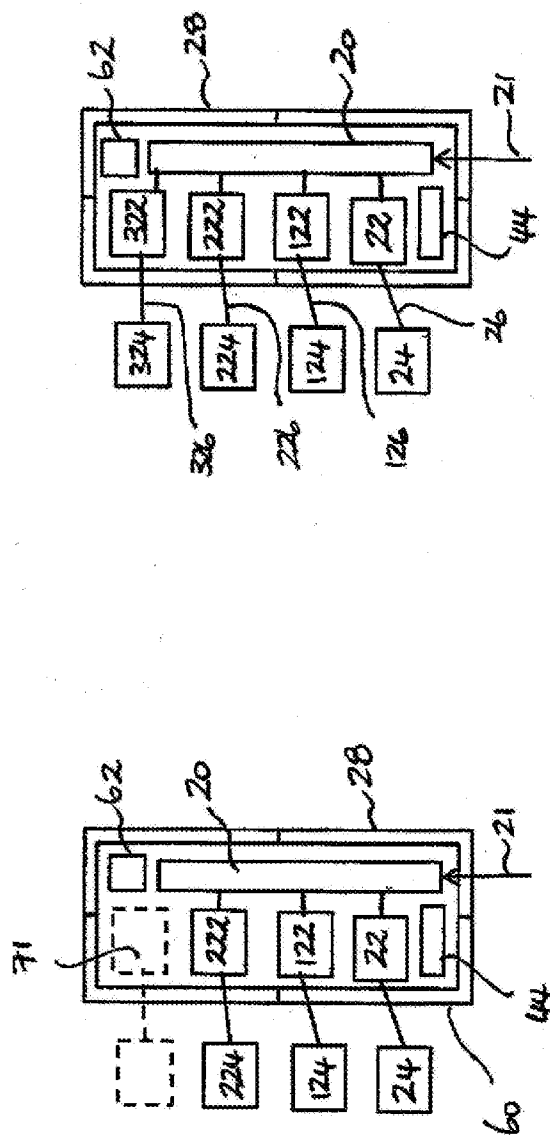


FIG. 21

FIG. 20

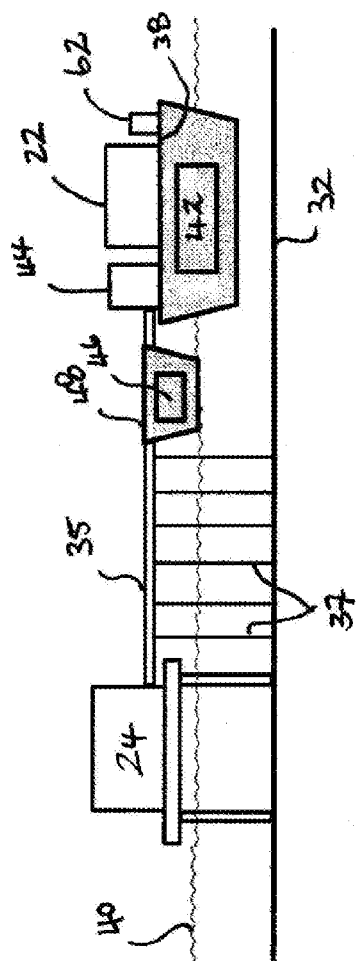


FIG. 22

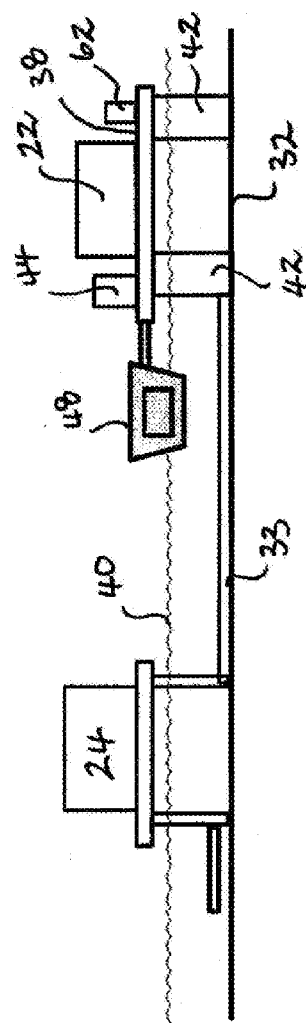


FIG. 23

EXPANDABLE LNG PROCESSING PLANT

FIELD OF THE INVENTION

[0001] The present invention relates to an expandable liquefied natural gas (LNG) processing plant. More particularly, some embodiments of the invention are related to LNG production plants. Other embodiments of the invention are related to natural gas regasification plants.

BACKGROUND TO THE INVENTION

[0002] Large volumes of natural gas (i.e., primarily methane) are located in remote areas of the world. This gas has significant value if it can be economically transported to market. Natural gas ("NG") is routinely transported from an onshore LNG production plant to another location in its liquid state as liquefied natural gas ("LNG") by way of loading the LNG in the cryogenic storage tanks of purpose built large ocean going vessels known as "LNG Carriers". Liquefaction of the natural gas makes it more economical to transport as LNG occupies only about 1/600th of the volume than the same amount of natural gas does in its gaseous state. Prior to liquefaction, raw natural gas that has been sourced from a wellhead is subjected to a series of gas pre-treatment processes including acid gas removal and dehydration to remove contaminants. After liquefaction, LNG is typically stored in cryogenic storage tanks at the LNG production plant either at or slightly above atmospheric pressure at a temperature of around -160 degrees Celsius.

[0003] Gas pre-treatment, liquefaction and storage are typically undertaken at a fixed onshore LNG production plant associated with a jetty that is built in sufficiently deepwater to allow berthing of the LNG Carriers. A typical LNG Carrier can be 300 m long with a draft of 15 to 20 meters. The docking of such LNG Carriers requires special conditions of water depth and sea state. In some countries, it is necessary to construct a pipeline and jetty several kilometers offshore to locate water that is deep enough to allow the approach of an LNG Carrier. The costs associated with the construction and installation of a jetty to allow berthing of an LNG Carrier is a major cost. To ship liquefied natural gas (LNG) by sea, a way to transfer LNG between the cryogenic storage tanks of the onshore LNG production plant and the cryogenic storage tanks of the LNG Carrier is required. Traditionally, the transfer means has taken the form of an insulated pipe that is laid on an elevated supporting trestle structure between the onshore LNG production plant and the jetty so that the insulated pipe remains at all times above the water line. These prior art transfer facilities include a vapour return line to return boil-off gas to the onshore LNG production plant. After LNG have been loaded into the cryogenic storage tanks of the LNG Carrier vessel for marine transport LNG is regasified before distribution to end users through a pipeline or other distribution network at a temperature and pressure that meets the delivery requirements of the end users.

[0004] The cost of traditional onshore LNG storage and offloading facilities has continued to increase through the years and is now a very significant component of the total installed cost for an LNG project. Efforts to reduce this cost have largely been focused on storage tank size optimization and seeking to leverage the economics of scale via increased LNG train capacity size and improvement in LNG berth utilization. To avoid the costs associated with the construction of a port to service an onshore LNG production facility, it has

been proposed to produce LNG at sea. In this context, the entire LNG production is performed on a floating LNG production vessel. Alternatively, it has been proposed to conduct gas pre-treatment onshore with liquefaction conducted offshore on a floating vessel with equipment optimized in terms of size and layout to keep deck size to a minimum. Such gas pre-treatment includes the removal of water, sour gas species (CO_2 and H_2S) and heavy hydrocarbons. The pre-treated gas is then sent by pipeline to the floating liquefaction facility. Given their size and complexity, the costs associated with the implementation of a complete LNG liquefaction plant at sea are extremely high.

[0005] Onshore plants used to liquefy natural gas are typically built in stages as the supply of feed gas, i.e. natural gas, and the quantity of gas contracted for sale, increase. Each stage normally consists of a separate, stand-alone unit, commonly called an 'LNG train'. An LNG train comprises all of the individual components necessary to liquefy a stream of feed gas into LNG and send it on to a cryogenic storage tank. As the supply of feed gas to the plant exceeds the capacity of one stand-alone LNG train, additional stand-alone LNG trains are installed at the onshore plant, as needed, to handle increasing LNG production. In contrast, the processing feed rate of an LNG plant onboard a floating LNG production vessel, once constructed, cannot be altered, as all available deck space is utilised and optimised to keep the overall size of the floating LNG production vessel to a minimum.

[0006] The cost of LNG storage and offloading facilities has continued to increase through the years and is now a very significant component of the total installed cost for an LNG project. Efforts to reduce this cost have largely been focused on storage tank size optimization and seeking to leverage the economics of scale via increased LNG train capacity size and improvement in LNG berth utilization.

[0007] There remains a need for an alternative LNG processing plant that may address one or more of the above-described disadvantages of conventional LNG processing plants.

SUMMARY OF THE INVENTION

[0008] According to a first aspect of the present invention there is provided an LNG processing plant positioned at a processing location adjacent to a body of water, the LNG processing plant comprising:

[0009] A) a first phase LNG processing plant for processing an initial plant capacity of LNG, the first phase LNG processing plant comprising a plurality of first phase facilities, each first phase facility provided with plant equipment related to a pre-determined function associated with the processing of LNG, wherein one or more of the plurality of first phase facilities is arranged on a deck of a structure wherein the deck is arranged above the level of the water at a selected offshore or near-shore location; and,

[0010] B) one or more second phase facilities provided on the deck of the structure to provide a second phase LNG processing plant, said second phase LNG processing plant having a maximum plant capacity that is higher than the initial plant capacity, wherein the one or more second phase facilities are provided to expand the plant capacity of the first phase LNG processing plant in one or more incremental stages, and, the deck of the struc-

ture is sized to provide a pre-allocated space for the installation of the one or more second phase facilities on the deck of the structure.

[0011] In one form, the one or more of the plurality of first phase facilities is arranged towards a first end of the deck with the pre-allocated space being arranged towards a second opposite end of the deck. In one form, the one or more of the plurality of first phase facilities is arranged towards a first side of the deck with the pre-allocated space being arranged towards a second opposite side of the deck.

[0012] In one form, the structure is a fixed structure or a floating structure or a gravity based structure having a base that rests on the seabed at the selected location.

[0013] In one form, the structure includes a first cryogenic storage tank for receiving and storing LNG. In one form, the first cryogenic storage tank is prismatic storage tank or a membrane storage tank. In one form, the first cryogenic storage tank is one of a plurality of first cryogenic storage tanks. In one form, the first cryogenic storage tank has an LNG storage capacity of at least 160,000 m³. In one form, the first cryogenic storage tank has an LNG storage capacity in the range of 160,000 m³ to 520,000 m³.

[0014] In one form, the structure has a length of up to 500 meters and a width of up to 150 meters. In one form, the structure has a depth of up to 50 metres.

[0015] In one form, the initial plant capacity of the first phase LNG processing plant is in the range of 0.5 to 7 million tons per annum of LNG. In one form, the maximum plant capacity after expansion to provide the second phase LNG processing plant is in the range of 2 million to 50 million tons per annum of LNG. In one form, one or more of the plurality of first phase facilities is sized for processing both the initial plant capacity and the maximum plant capacity.

[0016] In one form, one or more of second phase facilities is located on a fixed platform, a semi-submersible or a jacket structure.

[0017] In one form, the one of more second phase facilities are modules having a weight of greater than 7,000 tons. In one form, the modules have a weight of greater than 8,000 tons and up 100,000 tons.

[0018] In one form, the gravity structure includes one or both of a condensate storage tank and an LPG storage tank.

[0019] In one form, the structure includes an LNG transfer facility for loading LNG between from the first cryogenic storage tank of the structure to a second cryogenic storage tank onboard an LNG Carrier, or for unloading of LNG from the second cryogenic storage tank of an LNG Carrier to the first cryogenic storage tank of the structure.

[0020] In one form, the structure is constructed at a construction location and floated in to the first processing location before being positioned at the selected location. In one form, the structure is arranged to provide a breakwater for an LNG Carrier at the selected location.

[0021] In one form, the structure is transportable from a first processing location to a second processing location. In one form, the structure is a gravity based structure and the gravity based structure includes a ballast storage compartment arranged around the periphery of the gravity based structure or arranged toward the base of the gravity based structure, for ballasting. In one form, the ballast storage compartment is one of a plurality of ballast storage compartments.

[0022] In one form, the LNG processing plant is an LNG production plant arranged to receive a feed stream of natural gas and liquefy the natural gas to produce a product stream of LNG.

[0023] In one form, the first phase LNG processing plant includes a first phase gas receiving facility for receiving a hydrocarbon stream comprising hydrocarbon gas and liquids and separating the liquids, including one or both of condensate and free water, from the hydrocarbon stream to produce a hydrocarbon feed gas stream for a gas pre-treatment facility. In one form, the first phase gas receiving facility is arranged on the deck of the structure. In one form, the first phase gas receiving facility is arranged offshore or subsea. In one form, the first phase gas receiving facility is arranged onshore.

[0024] In one form, the first phase LNG processing plant includes a first phase gas pre-treatment facility for receiving a hydrocarbon feed gas stream from a gas receiving facility and removing contaminants from the hydrocarbon feed gas stream to produce a stream of pre-treated gas. In one form, the first phase gas pre-treatment facility is arranged on the deck of the structure. In one form, the first phase gas pre-treatment facility is arranged onshore. In one form, the first phase gas pre-treatment facility is arranged offshore. In one form, the first phase LNG processing plant includes a first phase LNG liquefaction facility for receiving the stream of pre-treated gas from a gas pre-treatment facility and liquefying the natural gas to produce a product stream of LNG.

[0025] In one form, the first phase LNG liquefaction facility is arranged on the deck of the structure. In one form, the first phase LNG liquefaction facility is arranged onshore. In one form, the first phase LNG liquefaction facility is arranged offshore. In one form, the structure includes a boil-off gas reliquefaction facility for liquefying at least a portion of the boil off gas that is generated in first cryogenic storage tank.

[0026] In one form, the LNG processing plant is an LNG regasification plant arranged to receive a feed stream of LNG and vaporise the LNG to produce a product stream of natural gas. In one form, the first phase LNG regasification plant includes a first phase power generation facility for generating a supply of power using a first phase product stream of natural gas as a source of fuel to generate electricity. In one form, the first phase power generation facility is arranged on the deck of the structure. In one form, the first phase power generation facility is arranged offshore. In one form, the first phase power generation facility is arranged onshore. In one form, the first phase power generation facility is a pre-existing onshore power plant.

[0027] In one form, the first phase LNG regasification plant includes a first phase vaporised gas receiving facility arranged to receive a stream of vaporised natural gas from a first phase regasification facility and send out a first phase product stream of vaporised natural gas. In one form, the first phase vaporised gas receiving facility is arranged on the deck of the structure. In one form, the first phase vaporised gas receiving facility is arranged offshore. In one form, first phase vaporised gas receiving facility is arranged onshore. In one form, the first phase LNG regasification plant includes a first phase regasification facility arranged to vaporise a first phase feed stream of LNG to produce a first phase stream of vaporised natural gas which is transferred to a first phase vaporised gas receiving facility. In one form, the first phase regasification facility is arranged on the deck of the structure. In one

form, the first phase regasification facility is arranged offshore. In one form, the first phase regasification facility is arranged onshore.

[0028] In one form, the initial plant capacity is at least 0.5 million tons per year and the maximum feed processing capacity is at least 2 million tons per year. In one form, the first initial plant capacity is at least 0.5 million tons per year and the maximum feed processing capacity is not greater than 50 million tons per year. In one form, the first initial plant capacity is at least 0.5 million tons per year and the maximum feed processing capacity is not greater than 70 million tons per year.

[0029] According to a second aspect of the present invention there is provided a method of processing LNG in an LNG processing plant is positioned at a processing location adjacent to a body of water, the method comprising:

[0030] A) providing a first phase LNG processing plant for processing an initial plant capacity of LNG, the first phase LNG processing plant comprising a plurality of first phase facilities, each first phase facility having plant equipment related to a pre-determined function associated with the processing of LNG, wherein one or more of the plurality of first phase facilities is arranged on a deck of a structure, wherein the deck is arranged above the level of the water at a selected offshore or near-shore location; and,

[0031] B) expanding the plant capacity of the first phase LNG processing plant in one or more incremental stages by providing one or more second phase facilities on the deck of the structure to provide a second phase LNG processing plant, said second phase LNG processing plant having a maximum plant capacity that is higher than the initial plant capacity, wherein the deck of the structure is sized to provide a pre-allocated space for the installation of the one or more second phase facilities on the deck of the structure.

[0032] In one form, the step of processing LNG from the first phase LNG processing plant during step B). In one form, the step of arranging the one or more of the plurality of first phase facilities towards a first end of the deck with the pre-allocated space being arranged towards a second opposite end of the deck. In one form, the step of arranging the one or more of the plurality of first phase facilities towards a first side of the deck with the pre-allocated space being arranged towards a second opposite side of deck.

[0033] In one form, the initial plant capacity of the first phase LNG processing plant is in the range of 0.5 to 7 million tons per annum of LNG. In one form, the maximum plant capacity after the step of expanding to the second phase LNG processing plant is in the range of 2 million to 70 million tons per annum of LNG. In one form, the step of sizing the one or more of the plurality of first phase facilities for processing both the initial plant capacity and the maximum plant capacity.

[0034] In one form, the step of locating one or more of second phase facilities is on a fixed platform, a semi-submersible or a jacket structure. In one form, the method comprising providing the one or more second phase facilities as modules having a weight of greater than 7,000 tons. In one form, the modules have a weight of greater than 8,000 tons and up to 100,000 tons.

[0035] In one form, the method comprises the step of constructing the structure at a construction location and floating the structure into the first processing location for positioning

of the structure at the selected location. In one form, the method comprises the step of arranging the structure to provide a breakwater for an LNG Carrier at the selected location. In one form, the method comprises the step of moving the structure from a first processing location to a second processing location. In one form, the LNG processing plant is an LNG production plant arranged to receive a feed stream of natural gas and liquefy the natural gas to produce a product stream of LNG. In one form, the LNG processing plant is an LNG regasification plant arranged to receive a feed stream of LNG and vaporise the LNG to produce a product stream of natural gas.

[0036] In one form, the initial plant capacity is at least 0.5 million tons per year and the maximum feed processing capacity is not greater than 50 million tons per year. In one form, the initial plant capacity is at least 2 million tons per year and the maximum feed processing capacity is not greater than 50 million tons per year.

BRIEF DESCRIPTION OF THE DRAWINGS

[0037] In order to facilitate a more detailed understanding of the nature of the invention several embodiments of the present invention will now be described in detail, by way of example only, with reference to the accompanying drawings, in which:

[0038] FIG. 1 is a schematic plan view of a first embodiment illustrating one incremental stage of expansion of an LNG processing plant with the first phase LNG processing plant shown in solid lines and the second phase LNG processing plant shown in dotted lines;

[0039] FIG. 2 is a schematic plan view of the first embodiment of an LNG processing plant with the first phase LNG processing plant shown in solid lines and the second phase LNG processing plant shown in solid lines;

[0040] FIG. 3 is a schematic side view of the first embodiment of an LNG processing plant illustrating a subsea pipeline extending from onshore to a gravity based structure;

[0041] FIG. 4 is a schematic side view of the first embodiment of an LNG processing plant illustrating a trestle extending from onshore to a gravity based structure;

[0042] FIG. 5 is a schematic representation of the structure being floated or towed from a construction location or an assembly location to a first processing location or being de-ballasted at a first processing location and floated or towed to a second processing location for re-ballasting;

[0043] FIG. 6 is a schematic plan view of a second embodiment illustrating one incremental stage of expansion of an LNG processing plant with the first phase LNG processing plant shown in solid lines and the second phase LNG processing plant shown in dotted lines, with all facilities being arranged on the deck of the structure;

[0044] FIG. 7 is a schematic plan view of the second embodiment of an LNG processing plant with the first phase LNG processing plant shown in solid lines and the second phase LNG processing plant shown in solid lines, with all facilities being arranged on the deck of the structure;

[0045] FIG. 8 is a schematic plan view of a third embodiment illustrating one incremental stage of expansion of an LNG processing plant with the first phase LNG processing plant shown in solid lines and the second phase LNG processing plant shown in dotted lines, with all of the facilities located on the deck of the structure;

[0046] FIG. 9 is a schematic plan view of a third embodiment illustrating one incremental stage of expansion of an

LNG processing plant with the first phase LNG processing plant shown in solid lines and the second phase LNG processing plant shown in dotted lines, with one of the facilities located off the deck of the structure;

[0047] FIG. 10 is a schematic plan view of a third embodiment illustrating one incremental stage of expansion of an LNG processing plant with the first phase LNG processing plant shown in solid lines and the second phase LNG processing plant shown in dotted lines, with one of the facilities located onshore;

[0048] FIG. 11 is a schematic plan view of a fourth embodiment illustrating one incremental stage of expansion of an LNG processing plant with the first phase LNG processing plant shown in solid lines and the second phase LNG processing plant shown in dotted lines, with all of the facilities located on the deck of the structure;

[0049] FIG. 12 is a schematic plan view of a fourth embodiment illustrating one incremental stage of expansion of an LNG processing plant with the first phase LNG processing plant shown in solid lines and the second phase LNG processing plant shown in dotted lines, with one of the facilities located off the deck of the structure;

[0050] FIG. 13 is a schematic plan view of a fourth embodiment illustrating one incremental stage of expansion of an LNG processing plant with the first phase LNG processing plant shown in solid lines and the second phase LNG processing plant shown in dotted lines, with one of the facilities located onshore;

[0051] FIG. 14 is a schematic plan view of a fifth embodiment illustrating three incremental stages of expansion of an LNG processing plant with the first phase LNG processing plant shown in solid lines and the second phase LNG processing plant shown in dotted lines;

[0052] FIG. 15 is a schematic plan view of the fifth embodiment of an LNG processing plant with the first phase LNG processing plant shown in solid lines and the second phase LNG processing plant shown in solid lines, after the addition of the first incremental stage;

[0053] FIG. 16 is a schematic plan view of the fifth embodiment of an LNG processing plant with the first phase LNG processing plant shown in solid lines and the second phase LNG processing plant shown in solid lines, after the addition of the first and second incremental stages;

[0054] FIG. 17 is a schematic plan view of the fifth embodiment of an LNG processing plant with the first phase LNG processing plant shown in solid lines and the second phase LNG processing plant shown in solid lines, after the addition of the first, second, and third and final incremental stages;

[0055] FIG. 18 is a schematic plan view of a sixth embodiment illustrating three incremental stages of expansion of an LNG processing plant by adding units or facilities installed on a fixed structure, with the first phase LNG processing plant shown in solid lines and the second phase LNG processing plant shown in dotted lines;

[0056] FIG. 19 is a schematic plan view of the sixth embodiment of an LNG processing plant with the first phase LNG processing plant shown in solid lines and the second phase LNG processing plant shown in solid lines, after the addition of the first incremental stage;

[0057] FIG. 20 is a schematic plan view of the sixth embodiment of an LNG processing plant with the first phase LNG processing plant shown in solid lines and the second phase LNG processing plant shown in solid lines, after the addition of the first and second incremental stages;

[0058] FIG. 21 is a schematic plan view of the sixth embodiment of an LNG processing plant with the first phase LNG processing plant shown in solid lines and the second phase LNG processing plant shown in solid lines, after the addition of the first, second, and third and final incremental stages;

[0059] FIG. 22 is a schematic side view of the sixth embodiment of an LNG processing plant illustrating a trestle extending from onshore to a floating structure; and,

[0060] FIG. 23 is a schematic side view of the sixth embodiment of an LNG processing plant illustrating a subsea pipeline extending from onshore to a fixed structure.

[0061] It is to be noted that the drawings illustrate only preferred embodiments of the invention and are therefore not to be considered limiting of the invention's scope as it may admit to other equally effective embodiments. Like reference numerals refer to like parts. The components in the figures are not necessarily to scale, emphasis instead being placed upon illustrating the principles of the invention. Moreover, all drawings are intended to convey concepts, where relative sizes, shapes and other detailed attributes may be illustrated schematically rather than literally or precisely.

DETAILED DESCRIPTION OF PARTICULAR EMBODIMENTS

[0062] Particular embodiments of the present invention are now described. The terminology used herein is for the purpose of describing particular embodiments only, and is not intended to limit the scope of the present invention. Unless defined otherwise, all technical and scientific terms used herein have the same meanings as commonly understood by one of ordinary skill in the art to which this invention belongs.

[0063] The acronym 'LNG' refers to liquefied natural gas. The acronym 'LPG' refers to liquefied petroleum gas. The term 'LNG Carrier' refers to a marine transport vessel that is capable of carrying a cargo of liquefied natural gas over water.

[0064] The term 'onshore facility' as used in this specification and in the claims refers to a facility that is arranged entirely on land, preferably near a coastline.

[0065] The term 'offshore facility' as used in this specification and in the claims refers to a facility that is arranged entirely in or over water, whereby the facility is surrounded by seawater in all directions. The term 'near-shore facility' as used in this specification and in the claims refers to an offshore facility that is located in shallow water. The term 'shallow water' as used in this specification and in the claims refers to water that has a water depth of less than 50 m or less than 15 m or less than 10 m or less than 5 m deep.

[0066] The distance between the onshore facility and the offshore facility where there is a connecting pipeline may vary. This distance is preferably greater than or equal to 5 km or greater than or equal to 10 km, or greater than or equal to 15 km, or greater than or equal to 20 km, or greater than or equal to 30 km or greater than or equal to 200 km.

[0067] As used herein and in the claims the phrase 'LNG processing plant' means any processing plant that produces a product that is changed in some way from the feed, with the feed or the product being LNG. One example of a LNG processing plant is a LNG production plant for producing LNG. Another example of a LNG processing plant is a LNG vaporisation or regasification plant where the feed is LNG.

[0068] As used herein and in the claims the phrase 'liquefaction facility' means a facility that processes a feed stream that includes gaseous methane into a product stream that

includes liquid methane. An LNG liquefaction plant includes at least one cryogenic heat exchanger and at least one refrigerant compression system.

[0069] As used herein and in the claims, the phrase ‘gas pre-treatment facility’ means a facility that receives a feed stream which includes at least methane, ethane, carbon dioxide, and hydrogen sulfide and produces a pre-treated gas stream which contains methane and reduced amounts of the other non-methane species as compared to the feed stream. The gas pre-treatment plant may include equipment for the removal of hydrogen sulphide, carbon dioxide and water. The gas pre-treatment plant may optionally include equipment for the removal of mercury. The gas pre-treatment plant may include equipment for the removal of heavy hydrocarbons. The term ‘heavy hydrocarbon’ refers to a hydrocarbon compound with more than three carbon atoms in the chain.

[0070] Using the method and system of the present invention LNG is processed in an LNG processing plant is positioned at a processing location adjacent to a body of water, the method comprising:

[0071] A) providing a first phase LNG processing plant for processing an initial plant capacity of LNG, the first phase LNG processing plant comprising a plurality of first phase facilities, each first phase facility having plant equipment related to a pre-determined function associated with the processing of LNG, wherein one or more of the plurality of first phase facilities is arranged on a deck of a structure, wherein the deck is arranged above the level of the water at a selected offshore or near-shore location; and,

[0072] B) expanding the plant capacity of the first phase LNG processing plant in one or more incremental stages by providing one or more second phase facilities on the deck of the structure to provide a second phase LNG processing plant, said second phase LNG processing plant having a maximum plant capacity that is higher than the initial plant capacity, wherein the deck of the structure is sized to provide a pre-allocated space for the installation of the one or more second phase facilities on the deck of the structure.

[0073] In order to facilitate expansion, the deck of the structure is designed and sized to provide a pre-allocated space on the deck for the installation of the one or more second phase facilities on the deck. Advantageously, processing of LNG from the first phase LNG processing plant is able to continue during the step of expansion. The first phase LNG processing plant is arranged on the deck of the structure in such a way as to provide easy access to the pre-allocated space.

[0074] The LNG processing plant may be an LNG production plant arranged to receive a feed stream of natural gas and liquefy the natural gas to produce a product stream of LNG with reference to the first to the sixth embodiments of the present invention as described in detail below. Alternatively, the LNG processing plant may be a LNG regasification plant arranged to receive a feed stream of LNG and produce and product stream of natural gas as described in detail below with reference to a seventh embodiment.

[0075] A first embodiment of the present invention is now described with reference to FIGS. 1 to 4 in the context of the LNG processing plant being an LNG production plant. More specifically, there is provided a first phase LNG production plant for producing an initial plant capacity of LNG, the first phase LNG production plant comprising a plurality of spaced-apart facilities, each facility provided with plant

equipment related to a pre-determined function associated with the liquefaction of LNG. The first phase LNG production plant includes at least the following facilities:

[0076] a) a gas receiving facility for receiving a hydrocarbon stream comprising hydrocarbon gas and liquids and separating the liquids, including one or both of condensate and free water, from the hydrocarbon stream to produce a hydrocarbon feed gas stream for a gas pre-treatment facility;

[0077] b) a gas pre-treatment facility for receiving a hydrocarbon feed gas stream from the gas receiving facility and removing contaminants from the hydrocarbon feed gas stream to produce a stream of pre-treated gas;

[0078] c) a liquefaction facility for receiving the stream of pre-treated gas from a gas pre-treatment facility and liquefying the natural gas to produce a product stream of LNG;

[0079] d) a storage facility operatively associated with a transfer means for receiving the product stream of LNG from the liquefaction facility for receiving and storing LNG in a first cryogenic storage tank; and,

[0080] e) an offloading facility including LNG transfer facilities to transfer the LNG from the first cryogenic storage tank of the storage facility to a second cryogenic storage tank onboard an LNG Carrier on an as-needs basis.

[0081] Referring to FIGS. 1 to 4, an LNG processing plant 10, in the form of an LNG production plant, is positioned at a first processing location 12 adjacent to a body of water 14. The LNG production plant 10 includes a first phase LNG production plant 16 for producing an initial plant capacity of LNG illustrated in solid lines in both FIG. 1 and FIG. 2, with a pre-allocated space provided on the deck of the structure for the later expansion of the LNG processing plant 10 in one or more incremental stages to provide a second phase LNG production plant 18, said second phase LNG production plant having a maximum plant capacity that is higher than the initial plant capacity. The second phase LNG production plant 18 is illustrated in dotted lines in FIG. 1 and solid lines in FIG. 2. In the first embodiment illustrated in FIGS. 1 and 2, the plant capacity of the first phase LNG production plant 16 is increased in one incremental stage by installing one or more second phase facilities to provide the second phase production plant. This expansion is able to be conducted without interruption to the processing of LNG by the first phase LNG production plant.

[0082] In the first embodiment now described with reference to FIGS. 1 to 4, the first phase LNG production plant 16 includes a first phase gas receiving facility 20 (hereinafter referred to as a ‘slugcatcher’) for receiving a hydrocarbon stream 21 comprising hydrocarbon gas and liquids and separating the liquids, including one or both of condensate and free water, from the hydrocarbon stream to produce a first phase hydrocarbon feed gas stream 23. The LNG production plant 10 includes a first phase offshore gas pre-treatment facility 22 for producing a first phase stream of pre-treated gas 25. In this embodiment, the first phase LNG production plant 16 includes a first phase liquefaction facility 24 for receiving the first phase stream of pre-treated gas 25 from the gas pre-treatment facility 22 and liquefying the first phase pre-treated gas stream 25 to produce a first phase product stream of LNG 26. The first phase product stream of LNG is pro-

duced at a rate that is determined by the initial plant capacity of LNG of the first phase LNG production plant 16.

[0083] By way of example only, the initial plant capacity of the first phase LNG production plant is in the range of 0.5 to 7 million tons per annum of LNG. The maximum plant capacity after expansion to provide the second phase LNG production plant is in the range of 2 million to 50 million tons per annum of LNG.

[0084] The first phase gas pre-treatment facility 22 includes equipment for acid gas removal, dehydration and, optionally, mercury removal and heavy hydrocarbon removal of the kind that is known in the art. Liquefaction is achieved in the first phase liquefaction facility 24 using any liquefaction process well established in the art which typically involve compression, expansion and cooling. Such prior art liquefaction processes include processes based on a nitrogen cycle, the APCI C3/MR™ or Split MR™ or AP-X™ processes, the Phillips Optimized Cascade Process, the Linde Mixed Fluid Cascade process, the Shell Double Mixed Refrigerant or Parallel Mixed Refrigerant process, or the Axens LIQUEFIN™ process.

[0085] In the embodiment illustrated in FIGS. 1 to 4, the LNG production plant 10 includes a structure 28 in the form of a gravity based structure having a base 30 that rests on the seabed 32 at a selected location 34 within the body of water 14, the gravity-based structure having a deck 38 arranged above the level 40 of the water at the selected location 34. The selected location is offshore or near-shore. The shoreline is designated with the reference numeral 29.

[0086] By way of example, when the structure is in the form of a gravity based structure, the gravity based structure may be constructed using lightweight or semi-lightweight concrete (having a density of less than about 2000 kg/m³). Alternatively or additionally, the gravity based structure may be constructed of steel or a hybrid comprising a combination of steel and concrete or a composite material. Advantageously, the gravity based structure is able to be constructed and commissioned at a construction location, such as a shipyard, where a trained and cost-efficient labour force is available and then floated in to the first processing location 12 before being positioned at the selected location 34. Alternatively, the structure may be constructed in the form of one or modules constructed on floated in barges or substructures with a topsides weight of up to 100,000 tons.

[0087] The structure 28 has a first cryogenic storage tank 42 operatively associated with the first phase liquefaction facility 24 for receiving LNG from the first phase liquefaction facility 24 and storing the first phase product stream of LNG in the first cryogenic storage tank 42. Preferably, the first cryogenic storage tank 42 is one of a plurality of first cryogenic storage tanks with two storage tanks shown in FIG. 3 by way of example only. The first cryogenic storage tank 42 may be a double containment, full containment, prismatic or membrane systems with a primary tank constructed from, by way of example, stainless steel, aluminum, and/or 9%-nickel steel. The first cryogenic storage tank may include pre-tensioned concrete to provide structural resistance to the stored LNG, boil off gas pressure loads and to external hazards. The structure 28 further includes an LNG transfer facility 44 for transferring LNG from the first cryogenic storage tank 42 to a second cryogenic storage tank 46 onboard an LNG Carrier 48. Advantageously, the structure 28 acts as a breakwater for the LNG Carrier 48 to reduce environmental loads on the LNG Carrier.

[0088] Referring to FIG. 5, the structure 28 is transportable from a construction location 50 to the first processing location 12 or from an assembly location 52 to the first processing location 12 by towing or on floating barges. The construction location 50 may be one of a plurality of constructions locations with three shown in FIG. 5 by way of example only. Advantageously, testing or pre-commissioning of the structure 28 can be conducted before transportation of the structure 28 to the processing location 14. This feature not only allows the structure to be deployed where required but is also advantageous when maintenance or upgrading is required. The structure may be re-deployed at a different location at a later time to suit LNG supply and demand, for example, due to changes in the capacity of the LNG production plant or towards the end of a gas field life. Thus with reference to FIG. 5, the structure can be moved from the first processing location 12 to a second processing location 13.

[0089] Referring to FIG. 3, the first phase feed gas stream from the slugcatcher 20 is delivered to the gravity based structure 28 via a subsea pipeline 33. Referring to FIG. 4, the first phase feed gas stream from the slugcatcher 20 is delivered to the gravity based structure 28 via a pipeline 35 arranged on a trestle 37. To allow sufficient water depth for an LNG Carrier 48 to berth alongside the gravity based structure 28, the selected location 34 has a water depth as measured from the waterline 40 to the seabed 32 of between 15 and 50 meters.

[0090] When the structure 28 is in the form of a gravity based structure, the gravity based structure includes a ballast storage compartment 56, preferably arranged around the periphery of the gravity based structure or arranged toward the base of the gravity based structure, for ballasting. For flexibility to adjust the level of ballasting to suit the seabed conditions at a given selected location 34, the ballast storage compartment 56 may be one of a plurality of ballast storage compartments with four ballast storage compartments shown in FIGS. 1 and 2, by way of example only. The gravity based structure 28 is towed from the construction or assembly location (50 or 52, respectively) to the first processing location 12 and then arranged at the selected location 34 where settling is achieved by the addition of a ballasting material to the ballast storage compartment 56 until the base 30 of the gravity based structure 28 rests on the seabed 32 to secure the position of the gravity based structure 28. This provides the gravity based structure with greater stability than a floating structure. The amount of ballasting material required to secure the gravity based structure to the seabed at the selected location depends on a number of relevant factors including but not limited to the shear strength of the underlying clay or silt material found at the bottom of the body of water at the selected location. If required, the gravity based structure 28 may include a piling system 58 to anchor the gravity based structure 28 into the seabed 32. The ballasting material may be a solid ballasting material or a liquid ballasting material. By way of example, one or both of iron ore and sand may be used as the solid ballast material. In one embodiment of the present invention, the liquid ballasting material is water, condensate, monoethylene glycol (MEG), methanol, diesel, demineralised water, LPG or combinations thereof. The liquid ballasting material may be stored in a non-cryogenic storage tank.

[0091] In this first embodiment of the present invention, the first phase LNG production plant 16 is provided for producing an initial plant capacity of LNG. The first phase LNG production plant 16 is provided with all of the equipment needed

to produce the initial plant capacity of LNG with the LNG so produced being stored in the first cryogenic storage tank onboard the structure 28. In use, an LNG Carrier 48 comes in to berth at the structure 28 to receive a cargo of LNG. When the LNG Carrier is docked at the structure 28 the first phase product stream of LNG 26 can be directed into the second cryogenic storage tank 46 onboard the LNG Carrier. When there is no LNG Carrier docked at the gravity based structure 28, the first phase product stream of LNG 26 is directed to the first cryogenic storage tank for storage onboard the gravity based structure 28.

[0092] The structure 28 is designed so that the LNG Carrier 48 may approach the structure from either direction depending on the prevailing weather conditions. A side of the structure that is sheltered from the prevailing weather conditions is referred to as the "lee side". Preferably, the structure 28 has a lee side 60, whereby, in use, the LNG Carrier 48 approaches the structure 28 from the lee side 60. The structure 28 is designed and sized to have at least one lateral side 68 which has a length of a sufficient size to allow an LNG carrier 48 to be docked along alongside the structure 28 without overhang of any portion of the LNG Carrier 48 beyond an end 61 of the gravity based structure. The structure 28 can be fitted with fendering equipment (not shown) to absorb a substantial portion of a load generated by any impact of the LNG Carrier 48 with the structure during transfer of LNG from the first cryogenic tank 32 to the second cryogenic tank 46.

[0093] The first cryogenic storage tank 42 which is arranged below the deck of the structure 28 is operatively associated with the first phase liquefaction facility 24 and receives a first phase product stream of LNG 26 from the first phase liquefaction facility 24. The integrated LNG transfer facility 44 located on the structure 28 includes a fixed or swivel joint loading arm or flexible hose above the water surface 40, preferably fitted with an emergency release system at one end of the loading arm or hose. Between transfer operations, the LNG transfer facility 44 may be kept cold by re-circulation of a small quantity of LNG. The LNG transfer facility 44 may include an emergency safety system to allow loading to be stopped if required in a quick, safe, and controlled manner by closing an isolation valve on the LNG transfer lines or shutting down the cargo pumps associated with the second cryogenic storage tank 46 onboard the LNG carrier 48. The emergency safety system is designed to allow LNG transfer to be restarted with minimum delay after corrective action has been taken.

[0094] In a preferred embodiment, the structure 28 includes a boil-off gas reliquefaction facility 63 for liquefying at least a portion of the boil off gas that is generated in first cryogenic storage tank 42 of the structure 28 or during the transfer of the LNG from the first cryogenic storage tank 42 to the second cryogenic storage tank 46 of the LNG Carrier 48. The reliquefied boil-off gas may be returned for storage in the first cryogenic storage tank. Boil off gas is generated due to one or more of the following: a) cooling down of the interior surfaces of the second cryogenic storage tank onboard the LNG Carrier; b) heat leaking in from the environment through the exterior surfaces of the second cryogenic storage tank onboard the LNG Carrier; c) heat from the cryogenic pumps used to transfer the LNG from the first cryogenic storage tank to the second cryogenic storage tank; and d) heat ingress from the LNG transfer facility transfer hoses or loading arms; e) flashing off due to a temperature increase during the transfer operation, and, f) flashing due to pressure drop during LNG

transfer from liquefaction to storage. Alternatively or additionally, a portion of the boil off gas may be used as a source of fuel for a first phase power generation system 62 arranged on the deck 38 of the structure 28. The first phase generation system 62 may be configured to provide power to the first phase LNG liquefaction facility 24 as well as providing power to other services and utilities of the structure 28, including the electrical utility systems, the crew and cargo systems and associated pumps, fans or other equipment associated with the liquefaction and gas pre-treatment facilities, the lighting systems, the accommodation unit, communications systems, inert gas and nitrogen generation systems, air supply systems, water systems, and waste treatment.

[0095] The first phase LNG production plant 16 described above and illustrated in solid lines in FIG. 1 is provided, commissioned, and operated at an initial plant capacity. Using the method and system of the present invention, the plant capacity of the first phase LNG production plant 16 is expanded in one or more incremental stages by installing one or more second phase facilities to provide a second phase LNG production plant, said second phase LNG production plant having a maximum plant capacity that is higher than the initial plant capacity. As can be seen from the arrangement of solid and dotted lines in FIG. 1, the first phase gas pre-treatment facility 22 and the first phase liquefaction facility 24 are arranged towards a first end 70 of the structure 28 with a pre-allocated space 71 being provided on the deck 32 of the structure 28 in anticipation of the subsequent addition of one or more process units to provide a second phase gas pre-treatment facility 122 and a second phase liquefaction facility 124. When installed, the second phase gas pre-treatment facility 122 and the second phase liquefaction facility 124 are arranged towards a second opposite end 72 of the structure 28. In this way, it is possible to continue to process LNG in the first phase LNG production plant 16 whilst undertaking the step of installing and commissioning the second phase LNG production plant 18 for expanding the overall plant capacity from the initial plant capacity to a maximum plant capacity.

[0096] Referring to FIG. 2, after expansion, the second phase LNG production plant 18 is arranged to receive a second phase hydrocarbon feed gas stream 123 from a second phase gas receiving facility 120 positioned onshore. In this embodiment, the second phase gas receiving facility 120 is arranged to receive a second phase hydrocarbon stream 121 comprising hydrocarbon gas and liquids and separating the liquids, including one or both of condensate and free water, from the hydrocarbon stream to produce the second phase hydrocarbon feed gas stream 123. In this embodiment, after expansion, the LNG production plant 10 includes a second phase offshore gas pre-treatment facility 122 for producing a second phase stream of pre-treated gas 125, and a second phase offshore liquefaction facility 124 for receiving the second phase stream of pre-treated gas 125 from the second phase gas pre-treatment facility 122 and liquefying the second phase pre-treated gas stream 125 to produce a second phase product stream of LNG 126. Using the first embodiment of the present invention illustrated in FIGS. 1 and 2, when the second phase product stream of LNG is combined with the first phase product stream of LNG, the overall plant capacity of the LNG production plant 10 has been expanded from the initial plant capacity to a maximum plant capacity in one incremental stage.

[0097] In the embodiment illustrated in FIGS. 1 to 4, the first cryogenic storage tank 42 is operatively associated with

both the first phase LNG production plant **16** and the second phase LNG production plant **18** and both the first phase LNG product stream and the second phase LNG product stream are stored in the first cryogenic storage tank **42** or in one of a plurality of first cryogenic storage tanks. By way of example, the second cryogenic storage tank may have an LNG storage capacity in the range of 125,000 m³ to 260,000 m³. The first cryogenic storage tank **32** has an LNG capacity of at least 160,000 m³. The upper limit of the LNG capacity of the one or more first cryogenic storage tanks aboard the gravity based structure is around 400,000 m³ to 520,000 m³. The LNG transfer facility **44** continues to perform the function of transferring LNG from the first cryogenic storage tank **42** to a second cryogenic storage tank **46** onboard an LNG Carrier **48** when an LNG Carrier is docked at the structure **28**.

[0098] In use, after expansion, an LNG Carrier **48** comes in to berth at the structure **28** to receive a cargo of LNG. When the LNG Carrier **48** is docked at the structure **28** one or both of the first phase product stream of LNG **26** and the second phase product stream of LNG **126** may be directed into one or more of the first cryogenic storage tank **42** of the gravity based structure **28** or directed into the second cryogenic storage tank **46** onboard the LNG Carrier **48** using the integrated transfer facilities **44**. When there is no LNG Carrier docked at the structure **28**, the first phase product stream of LNG **26** and the second phase product stream of LNG **126** are directed to the first cryogenic storage tank **42** for storage onboard the structure **28**.

[0099] In the first embodiment of the present invention illustrated with reference to FIGS. **1** to **4**, the first cryogenic storage tank **42** or the plurality of first cryogenic storage tanks **42** is/are sized from the outset to accommodate storage of LNG based on the maximum plant capacity of the LNG processing plant. In addition, the second phase LNG production plant **16** is provided with all of the equipment needed to produce the second phase product stream of LNG **126** with the LNG so produced being stored in the first cryogenic storage tank **42** onboard the gravity based structure **28**. In order to accommodate expansion, the structure is designed and sized to have a sufficient space on its deck **38** to allow for installation of the one or more second phase facilities to provide the second phase LNG production plant **18**. By way of example, the deck **38** of the structure may have a length of up to 370 meters and a width of up to 150 meters. The depth of the structure may be up to 50 metres.

[0100] A second embodiment of the present invention is now described with reference to FIGS. **6** and **7** for which like reference numerals refer to like parts. As for FIGS. **1** and **2**, the first phase LNG production plant **16** is shown in solid lines in FIG. **6** and FIG. **7** whilst the second phase LNG production plant **18** is shown in dotted lines in FIG. **6** with solid lines indicating that expansion has been completed in FIG. **7**. The dotted lines in FIG. **6** represent the pre-allocated space **71** provided on the deck **38** of the structure **28** for subsequent expansion. In this embodiment the first phase gas receiving facility **20** is arranged on the deck **38** of the structure **28** with a pre-allocated space **71** being provided on the deck **38** of the structure **28** in anticipation of the subsequent addition of the second phase gas receiving facility **120** to be installed at a later time when expansion of the plant capacity is desired. The pre-allocated space **71** is arranged towards a first side **81** of the structure **28** with the pre-allocated space being arranged towards a second opposite side **83** of the structure.

[0101] A third embodiment of the present invention is now described with reference to FIGS. **8** to **10** for which like reference numerals refer to like parts. As for FIGS. **1** and **2**, the first phase LNG production plant **16** is shown in solid lines in FIGS. **8** to **10** whilst the second phase LNG production plant **18** is shown in dotted lines. The dotted lines in FIGS. **8** to **10** represent the pre-allocated space **71** provided on the deck **38** of the structure **28** for subsequent expansion. In this embodiment, the first phase gas receiving facility **20** is designed and sized of sufficient capacity to produce both the first phase hydrocarbon feed gas stream **23** and the second phase hydrocarbon feed gas stream **123**. In other words, the first phase gas receiving facility **20** is capable not only of operating at the initial plant capacity prior to expansion, but is also capable of operating at the maximum plant capacity after one or more additional units are added to provide the second phase production plant **18**. In FIG. **8**, the first phase gas receiving facility **20** is arranged on the deck **38** of the structure **28**. In FIG. **9**, the first phase gas receiving facility **20** is arranged offshore or near-shore at a subsea location **78**. In FIG. **10**, the first phase gas receiving facility **20** is arranged onshore. In each of the embodiments illustrated in FIGS. **8** to **10**, the first phase gas facility **20** is designed and sized to perform the function of both the first phase gas facility **20** and the second phase gas facility **120**.

[0102] A fourth embodiment of the present invention is now described with reference to FIGS. **11** to **13** for which like reference numerals refer to like parts. As for FIGS. **1** and **2**, the first phase LNG production plant **16** is shown in solid lines in FIGS. **11** to **13** whilst the second phase LNG production plant **18** is shown in dotted lines. The dotted lines in FIGS. **11** to **13** represent the pre-allocated space **71** provided on the deck **38** of the structure **28** for subsequent expansion. In this embodiment, the first gas pre-treatment facility **22** is designed and sized of sufficient capacity to produce both the first phase pre-treated gas stream **25** and the second phase pre-treated gas stream **125**. In other words, the first phase gas pre-treatment facility **22** is capable not only of operating at the initial plant capacity prior to expansion, but is also capable of operating at the maximum plant capacity after one or more additional units are added to provide the second phase production plant **18**. In FIG. **11**, the first phase gas receiving facility **20** and the first phase pre-treatment facility **22** are arranged on the deck **38** of the structure **28**. Both are designed and sized to handle the maximum plant capacity but operate at the initial plant capacity prior to expansion. In FIG. **12**, the first phase gas receiving facility **20** and the first phase pre-treatment facility **22** are arranged onshore. As for FIG. **11**, both are designed and sized to handle the maximum plant capacity but operate at the initial plant capacity prior to expansion. In FIG. **13**, the first phase gas pre-treatment facility **22** is arranged on the structure **28** with the first phase gas receiving facility **20** being arranged at a subsea location **78**. As for FIG. **11**, both are designed and sized to handle the maximum plant capacity but operate at the initial plant capacity prior to expansion.

[0103] In each of the embodiments illustrated in FIGS. **1** to **4** and **6** to **13**, the plant capacity of the first phase LNG processing plant is expanded in one incremental stage from the initial plant capacity to the maximum plant capacity. However, the plant capacity of the first phase LNG processing plant could equally be expanded in more incremental stages from the initial plant capacity to the maximum plant capacity with three such incremental stages illustrated in the fifth embodiment now described with reference to FIGS. **14** to **17**

for like reference numerals refer to like parts. As for FIGS. 1 and 2, the first phase LNG production plant 16 is shown in solid lines in FIG. 14 whilst each of the three incremental stages of the second phase LNG production plant 18 are shown in dotted lines. It is to be understood that any number of incremental stages may be added to the expandable LNG processing plant of the present invention to achieve the desired maximum plant capacity, with one and three incremental stages being shown in the figures and described herein by way of example only. In the interests of clarity, the LNG Carrier is not shown in FIGS. 14 to 17. In FIG. 15, a first incremental stage 80 has been added to the plant to increase the plant capacity from the initial plant capacity of the first phase LNG processing plant to a first selected increased plant capacity. In FIG. 16, a second incremental stage 82 has been added to the plant to increase the plant capacity from the first selected increased plant capacity to a second increased plant capacity. In FIG. 17, a third and final incremental stage 84 has been added to the plant to increase the plant capacity from the second selected increased plant capacity to the maximum plant capacity. As can be seen from the arrangement of solid and dotted lines in FIGS. 14 to 17, the first phase facilities 16 are arranged towards a first end 70 of the structure 28 with space 71 on the deck 38 of the structure 28 pre-allocated for the installation of additional units for the first incremental stage 80, the second incremental stage 82, and, the third and final incremental stage 84.

[0104] In a sixth embodiment, now described with reference to FIGS. 18 to 24, for which like reference numerals refer to like parts, three incremental stages of expansion are illustrated as for FIGS. 14 to 17, by way of example only. The dotted lines in FIGS. 18 to 21 represent the pre-allocated space 71 provided on the deck 38 of the structure 28 for subsequent expansion. In this embodiment, the first phase gas receiving facility 20 is designed and sized to handle the initial plant capacity and each incremental increase in capacity up to the maximum plant capacity. In the interests of clarity, the LNG Carrier is not shown in FIGS. 18 to 21. The first phase gas receiving facility 20 may be located onshore, subsea or on the deck of the structure. In this embodiment, the plant capacity of the first phase LNG production plant 16 is expanded in three incremental stages by installing one or more second phase facilities on the deck of the structure. In this embodiment, the one or more second phase facilities take the form of one or more additional gas pre-treatment facilities 122, 222 and 322 in incremental stages to provide a second phase LNG production plant, said second phase LNG production plant having a maximum plant capacity that is higher than the initial plant capacity. It is apparent from FIGS. 18 to 21 that the deck of the structure is sized to provide sufficient room for installing the one or more additional gas pre-treatment facilities 122, 222 and 322 in the pre-allocated space 71.

[0105] Depending on the demand for LNG, the final incremental stage may not be required to be installed at the first processing location but may be required to be installed at the second processing location or vice versa. In any event, sufficient pre-allocated space on the deck of the structure is provided to allow expansion to occur with the first phase LNG production plant arranged on the deck of the gravity based structure in a configuration that allows optimum access for later installation of additional units.

[0106] In the sixth embodiment illustrated in FIGS. 18 to 21, one or more additional LNG liquefaction facilities 124, 224 and 324 are also added in incremental stages in sequence

with the one or more additional gas pre-treatment facilities 122, 222 and 322 to provide the second phase LNG production plant 18. As best seen in FIGS. 22 and 23, the one or more additional LNG liquefaction facilities 124, 224 and 324 are located on a fixed platform, a semi-submersible platform (such as a tension-leg platform or a "SPAR") or a "jacket" structure. This embodiment has a number of advantages. Firstly, it allows for the liquefaction facilities to be installed as modules of up to 100,000 tons in weight which is higher than the maximum size of module that can be installed onshore because these modules can be floated in and installed on the fixed structure, avoiding the limitations to size associated with heavy lifting for installation at an onshore facility. Onshore module installations are limited in size by the available crane capacity, limiting the highest possible size of an onshore module to around 7,000 tons. Secondly, it allows for the liquefaction facilities to be located at a safe working distance away from the gravity based structure which is particularly advantageous if the liquefaction facilities rely on propane for cooling as part of the liquefaction process. Power is supplied to the liquefaction modules from the first phase power generation facility 62 onboard the structure 28 via a subsea power cable with the compressors and liquefaction equipment being driven by electric motors. As each of the one or more additional LNG liquefaction facilities 124, 224 and 324 are added during expansion, one or more additional second phase power generation facilities (not shown) can be installed on the deck of the gravity based structure. This allows for a more compact design of the one or more additional LNG liquefaction facilities 124, 224 and 324. Alternatively, as illustrated in FIGS. 18 to 21, the first phase power generation facilities 62 can be designed and sized to meet the anticipated power demands of the expandable LNG processing plant when it is operating at both the initial plant capacity and the maximum plant capacity.

[0107] Using any of the embodiments described above, structure 28 may include one or both of a condensate storage tank and an LPG storage tank. By way of example, the condensate storage tank may be up to 130,000 m³ in size with the LPG storage tank being up to 90,000 m³ in size. Suitable marine vessels can berth at the gravity based structure for offloading of one or both of the condensate or LPG as desired.

[0108] The embodiments described above were all in the context of the LNG processing plant being used for LNG liquefaction. When the LNG processing plant is used for LNG regasification, the present invention provides a system and method of vaporising LNG in an LNG regasification plant positioned at a processing location adjacent to a body of water. The method comprises:

[0109] A) providing a first phase LNG regasification plant for vaporising an initial plant capacity of LNG, the first phase LNG regasification plant comprising a plurality of spaced-apart first phase facilities, each first phase facility provided with plant equipment related to a pre-determined function associated with the regasification of LNG, wherein one or more of the plurality of spaced-apart first phase facilities is arranged on a gravity based structure having a base that rests on the seabed at a selected location within the body of water, the gravity based structure having a deck arranged above the level of the water at an offshore or near-shore selected location; and,

[0110] B) expanding the plant capacity of the first phase LNG regasification plant in one or more incremental

stages by providing one or more second phase facilities on the deck of the gravity based structure to provide a second phase LNG regasification plant, said second phase LNG regasification plant having a maximum plant capacity that is higher than the initial plant capacity.

[0111] In order to facilitate expansion, the deck of the structure is designed and sized to provide a pre-allocated space on the deck for the installation of the one or more second phase facilities on the deck in an analogous manner to the embodiments described above for an LNG liquefaction plant. Advantageously, regasification of LNG from the first phase LNG regasification plant is able to continue during the step of expansion. The first phase LNG regasification plant is arranged on the deck of the gravity based structure in such a way as to provide easy access to the pre-allocated space.

[0112] Any of the embodiments illustrated in FIGS. 1 to 23 and described above in the context of the LNG processing plant being an LNG liquefaction plant could equally be modified for use as an LNG regasification plant by way of the following substitutions:

[0113] a) the first phase gas receiving facility is replaced with a first phase power generation facility 20 for generating a supply of power 21 using a first phase product stream of natural gas 23 as a source of fuel to generate electricity;

[0114] b) the second phase gas receiving facility is replaced with a second phase power generation facility 120 for generating electricity using a second phase stream of natural gas as a source of fuel (designed by reference numeral 123);

[0115] c) the first phase gas pre-treatment facility is replaced by a first phase vaporised gas receiving facility 22 arranged to receive a stream of vaporised natural gas 25 from a first phase regasification facility 24 and send out a first phase product stream of vaporised natural gas 25;

[0116] d) the second phase gas pre-treatment facility is replaced by a second phase vaporised gas receiving facility 122 arranged to receive a stream of vaporised natural gas from the second phase regasification facility 124 and send out a second phase product stream of vaporised natural gas 125;

[0117] e) the first phase liquefaction facility is replaced by the first phase regasification facility 24 arranged to vaporise a first phase feed stream of LNG 26 to produce the first phase stream of vaporised natural gas 25 which is transferred to the first phase vaporised gas receiving facility 22; and,

[0118] f) the second phase liquefaction facility is replaced by a second phase regasification facility 124 arranged to vaporise a second phase feed stream of LNG 126 to produce the second phase stream of vaporised natural gas 125 delivered to the second phase vaporised gas receiving facility 122.

[0119] The first cryogenic storage tank 42 of the structure 28 is used to store LNG for the LNG regasification plant in the same manner as it was used to store LNG for the LNG liquefaction plant. When used for regasification, the LNG transfer facilities 44 are used to transfer LNG from a second cryogenic storage tank 46 onboard an LNG Carrier 48 to the first storage tank 42 of the structure 28.

[0120] A seventh embodiment of the present invention is now described in detail with reference to the embodiment illustrated in FIGS. 1 and 2 in the context of the LNG pro-

cessing plant being an LNG regasification plant, with like reference numerals referring to like parts or the substitutions set out above. Referring to FIGS. 1 to 4, an LNG processing plant 10, in the form of an LNG regasification plant, is positioned at a first processing location 12 adjacent to a body of water 14. The LNG regasification plant 10 includes a first phase LNG regasification plant 16 for producing an initial plant capacity of LNG illustrated in solid lines in both FIG. 1 and FIG. 2, with a pre-allocated space 71 provided on the deck 38 of the structure 28 for the later expansion of the LNG processing plant 10 in one or more incremental stages to provide a second phase LNG regasification plant 18, said second phase LNG regasification plant having a maximum plant capacity that is higher than the initial plant capacity. The second phase LNG regasification plant 18 is illustrated in dotted lines in FIG. 1 and solid lines in FIG. 2. In the first embodiment illustrated in FIGS. 1 and 2, the plant capacity of the first phase LNG regasification plant 16 is increased in one incremental stage by installing one or more second phase facilities to provide the second phase LNG regasification plant. This expansion is able to be conducted without interruption to the processing of LNG by the first phase LNG regasification plant.

[0121] In the first embodiment now described with reference to FIGS. 1 to 4, the first phase LNG regasification plant 16 includes first phase power generation facility 20 for generating electricity using natural gas as a source of fuel. The LNG production plant 10 includes a first phase vaporised gas receiving facility 22 arranged to receive a stream of vaporised natural gas 25 from a first phase regasification facility 24. In this embodiment, the first phase LNG regasification plant 16 includes a first phase regasification facility 24 arranged to vaporise a first phase feed stream of LNG 26 to produce the first phase stream of vaporised natural gas 25 which is transferred to the first phase vaporised gas receiving facility 22. The first phase feed stream of LNG is vaporised at a rate that is determined by the initial plant capacity of LNG of the first phase LNG regasification plant 16. The initial plant capacity of the first phase LNG regasification plant 16 is in the range of 0.5 to 7 million tons per annum of LNG. The maximum plant capacity after expansion to provide the second phase LNG regasification plant 18 is in the range of 2 million to 20 million tons per annum of LNG.

[0122] Vaporisation of the LNG is achieved in the first phase regasification facility 24 using any regasification process well established in the art. Such prior art regasification processes include use of a variety of sources of heat for vaporization of LNG. However, the use of forced or natural draft ambient air as a primary source of heat for vaporization of LNG is preferred to keep emissions to a minimum compared with other regasification technologies that rely on the use of seawater or the burning of liquid fuels as the primary heat source for vaporization.

[0123] In the embodiment illustrated in FIGS. 1 to 4, the LNG regasification plant 10 includes a gravity based structure having a base 30 that rests on the seabed 32 at a selected location 34 within the body of water 36, the gravity based structure having a deck 38 arranged above the level 40 of the water at the selected location. The selected location is off-shore or near-shore. The gravity based structure 28 has a first cryogenic storage tank 42 for storage of LNG. The first cryogenic storage tank 42 is preferably one of a plurality of first cryogenic storage tanks with only one shown in the figures in the interests of clarity. The gravity based structure 28 further

includes an LNG transfer facility 44 for transferring LNG from a second cryogenic storage tank 46 onboard an LNG Carrier 48 to the first cryogenic storage tank 42. LNG from the first cryogenic storage tank is delivered as a first phase feed stream to the first phase regasification facility 24 for vaporisation.

[0124] Referring to FIG. 3, the first phase product stream of natural gas 23 is delivered from the gravity based structure 28 to the first phase power plant 20 via a subsea pipeline 33. Referring to FIG. 4, the first phase product stream of natural gas 23 is delivered from the gravity based structure 28 to the first phase power plant 20 via a pipeline 35 arranged on a trestle 37.

[0125] In this first embodiment of the present invention, the first phase LNG regasification plant 16 is provided for vaporising an initial plant capacity of LNG. The first phase LNG regasification plant 16 is provided with all of the equipment needed to vaporise the initial plant capacity of LNG with the LNG being stored in the first cryogenic storage tank onboard the gravity based structure. In use, an LNG Carrier 48 comes in to berth at the gravity based structure 28 to deliver a cargo of LNG. When the LNG Carrier is docked at the gravity based structure 28 the first phase feed stream of LNG 26 is offloaded from the second cryogenic storage tank 46 onboard the LNG Carrier 48 into one or more of the first cryogenic storage tanks 42 of the gravity based structure. When there is no LNG Carrier docked at the gravity based structure 28, the first phase feed stream of LNG 26 is sourced from the LNG stored in a first cryogenic storage tank 42 of the gravity based structure 28. Given the large capacity of the first cryogenic storage tank 42, this allows for the first phase power plant 20 to be provided with a continuous source of natural gas a fuel to generate electricity in between cargo deliveries from an LNG Carrier.

[0126] The first phase LNG regasification plant 16 described above and illustrated in solid lines in FIG. 1 is provided, commissioned, and operated at an initial plant capacity. Using the method and system of the present invention, the plant capacity of the first phase LNG regasification plant 16 is expanded in one or more incremental stages by installing one or more second phase facilities to provide a second phase LNG regasification plant 18, said second phase LNG regasification plant having a maximum plant capacity that is higher than the initial plant capacity. As can be seen from the arrangement of solid and dotted lines in FIG. 1, the first phase vaporised gas receiving facility 22 and the first phase regasification facility 24 are arranged towards a first end 70 of the structure 28 with a pre-allocated space 71 being provided on the deck 32 of the structure 28 in anticipation of the subsequent addition of one or more process units to provide the second phase gas vaporised gas receiving facility 122 and the second phase regasification facility 124. When installed, the second phase vaporised gas receiving facility 122 and the second phase regasification facility 124 are arranged towards a second opposite end 72 of the structure 28. In this way, it is possible to continue to vaporise LNG in the first phase LNG regasification plant 16 whilst undertaking the step of installing and commissioning the second phase LNG regasification plant 18 for expanding the overall plant capacity from the plant capacity to a maximum plant capacity.

[0127] Referring to FIG. 2, after expansion, the second phase LNG regasification plant 18 is arranged to produce a second phase natural gas product stream 123 to act as a source of fuel to a second phase power generation facility 120 posi-

tioned onshore. Using the first embodiment of the present invention illustrated in FIGS. 1 and 2, when the second phase feed stream of LNG 126 is combined with the first phase feed stream of LNG 26, the overall plant capacity of the LNG regasification plant 10 has been expanded from the initial plant capacity to a maximum plant capacity in one incremental stage. The number and arrangement of gas turbines used in the first power generation facility 20 and the second phase power generation facility 120 depends on the capacity of LNG regasification facility. Using this embodiment of the present invention, the first phase power generation facility 20 operates on the basis of the initial capacity of the first phase LNG regasification plant and is subsequently expanded to the maximum capacity of the second phase LNG regasification plant.

[0128] In an analogous manner, the second to sixth embodiments described in detail above can be applied to the vaporisation of LNG using the substitutions described above to change the LNG processing plant from a liquefaction plant to a regasification plant.

[0129] Using any of the LNG regasification embodiments illustrated in FIGS. 1 to 23, the first phase power generation facility 20 and the second phase power generation facility 120 use a product stream of natural gas (23 and 123, respectively) as a source of fuel for generating electricity. By way of example, the power generation facility 20 includes one or more gas-fired power generation units, in this example a gas turbine arranged to use unodorized natural gas that has been vaporized from LNG stored in the first cryogenic storage tank as a source of fuel gas. Natural gas which is generated during vaporization of LNG is "unodorized" in that sulfur compounds are removed from well head gas prior to liquefaction. In contrast, pipeline natural gas sourced from an onshore gas distribution facility includes a sulfur containing odorant which is deliberately added to gas intended for use by consumers prior to distribution for the purpose of facilitating detection of leaks. The use of "unodorized" vaporized LNG leads to a reduction in the level of sulfur dioxide produced in the exhaust gas from the gas turbine of the present invention. LNG also does not contain heavy hydrocarbons (which have been removed during gas conditioning prior to liquefaction) and this leads to reduction in the particulates present in the exhaust gas produced by the gas turbine of the present invention compared with a gas turbine operated using odorized natural gas from an onshore gas distribution facility. The unodorized natural gas is used as one of the sources of fuel for the gas turbines of the power generation facility is derived from one or more of the following sources: a) natural boil off gas from the first cryogenic storage tank; b) forced boil off gas from the first cryogenic storage tank; and, c) LNG vaporized to natural gas using the first or second phase regasification facilities.

[0130] Each gas turbine produces energy by combustion of a source of fuel gas mixed with intake air from an air compressor. The hot combustion gases are directed to flow across the blades (not shown) of the gas turbine, causing the turbine to spin providing rotation to a mechanical shaft to drive a first generator. Additional thrust can be provided by acceleration of the combustion gases through a nozzle. During combustion of any fuel gas, pollutants are produced which report to the exhaust gas. The quantity and type of pollutant produced in the exhaust gas depends on such relevant factors as the efficiency of combustion, the degree of air compression, the air-to-fuel ratio, the inlet temperature of the compressed air

and the fuel gas, the humidity of the inlet air, ignition timing, efficiency of combustion and the type of fuel gas supplied to the gas turbine. Advantageously, the power generation facility of the present invention uses unodorized natural gas that has been vaporized from LNG as the source of fuel gas, which produces a lower level of emissions and pollutants than would be produced by burning oil or coal to fire the burners of a traditional prior art steam turbine.

[0131] A fuel gas conditioning unit can be provided with temperature regulator for measuring and adjusting the temperature of the vaporized gas, as required, to improve the combustion efficiency of the gas turbine. Heat is supplied to the temperature regulator using electrical heating, steam heating, or by circulating a warm intermediate fluid.

[0132] It is readily apparent from the embodiments illustrated in FIGS. 1 to 23 that the first power generation facility 20 may be located onshore, offshore on the deck of the gravity based structure or near shore as a separate facility. The first phase power generation facility 20 may be an existing onshore power generation facility or purpose-built as one of the plurality of facilities of the first phase LNG regasification plant 16.

[0133] Whilst the various embodiments have been described above in the context of the structure 28 being a gravity based structure, the structure 28 may be in the form of a floating structure as illustrated by way of example only in FIG. 22, provided only that the deck of the structure is sized to provide a pre-allocated space for the installation of the one or more second phase facilities on the deck of the structure to facilitate expansion of the plant capacity of the first phase LNG processing plant in one or more incremental stages to form the second phase LNG processing plant. Alternatively, the structure may be a fixed platform, a semi-submersible platform (such as a tension-leg platform or a "SPAR") or a "jacket" structure as illustrated, by way of example only, in FIG. 23, provided that the deck of the structure is sized to provide a pre-allocated space for the installation of the one or more second phase facilities on the deck of the structure to facilitate expansion of the plant capacity of the first phase LNG processing plant in one or more incremental stages to form the second phase LNG processing plant.

[0134] Various embodiments of the present invention provide at least the following advantages over the prior art:

[0135] a) expansion of the capacity of the first phase processing plant the second phase processing plant is made possible using larger process units than those able to be accommodated during the expansion of an onshore processing plant. When conducting expansion operations onshore, the size of the modules that can be mobilized using cranes and land-based transport vehicles are limited to around 2500 to 7000 tons. In contrast, using the present invention, process units and modules of 30,000 to 40,000 tons and up to 100,000 tons can be floated in without ever needing to be lifted or transported on land.

[0136] b) sizing the first cryogenic storage tank onboard the structure to accommodate the initial plant capacity and the maximum plant capacity allows for the addition of second phase liquefaction facilities which do not require any LNG storage of their own. The result of this is that the size of the second phase liquefaction facilities can be larger than possible to achieve onshore.

[0137] c) the present invention provides an offshore LNG production option that is expandable in terms of

capacity which is not possible using prior art 'floating LNG' options which rely on the deck space being fully occupied with processing equipment.

[0138] d) the costs associated with the dredging and construction of port facilities to provide a jetty for berthing of LNG Carriers is avoided as the fixed or floating structure of the present invention provides berthing facilities and serves as a breakwater for LNG Carriers.

[0139] e) the structure can be manufactured in a shipyard and then floated in to the first processing location, which greatly reduces costs compared to in situ construction of a long jetty and breakwater reducing the cost of construction and installation.

[0140] f) In addition when the structure is a gravity based structure, the gravity based structure can be de-ballasted, transported from the first processing location to a second processing location, and re-ballasted at the second processing location, avoiding the costs associated with in situ construction of a jetty and breakwater at both the first processing location and the second processing location.

[0141] g) The structure can be used as a liquefaction plant, a regasification plant, or an offshore or near shore power station, whereby the capital costs are lower than the costs of a separate land based liquefaction plant, regasification plant or power station.

[0142] h) The structure can be provided with a first cryogenic storage tank with an extremely large storage capability which enables continuous operation of the LNG processing plants even though deliveries to or from LNG Carriers are made intermittently and, even more importantly, can be sized to accommodate the largest super-tankers.

[0143] i) Using the present invention results in substantial savings in the overall operation of the process at maximum capacity and provides for great ease in expanding the process incrementally.

[0144] Now that several embodiments of the invention have been described in detail, it will be apparent to persons skilled in the relevant art that numerous variations and modifications can be made without departing from the basic inventive concepts. All such modifications and variations are considered to be within the scope of the present invention, the nature of which is to be determined from the foregoing description and the appended claims.

[0145] It will be clearly understood that, although a number of prior art publications are referred to herein, this reference does not constitute an admission that any of these documents forms part of the common general knowledge in the art, in Australia or in any other country. In the summary of the invention, the description and claims which follow, except where the context requires otherwise due to express language or necessary implication, the word "comprise" or variations such as "comprises" or "comprising" is used in an inclusive sense, i.e. to specify the presence of the stated features but not to preclude the presence or addition of further features in various embodiments of the invention.

1. An LNG processing plant positioned at a processing location adjacent to a body of water, the LNG processing plant comprising:

A) a first phase LNG processing plant for processing an initial plant capacity of LNG, the first phase LNG processing plant comprising a plurality of first phase facilities, each first phase facility provided with plant equip-

ment related to a pre-determined function associated with the processing of LNG, wherein one or more of the plurality of first phase facilities is arranged on a deck of a structure wherein the deck is arranged above the level of the water at a selected offshore or near-shore location; and,

B) one or more second phase facilities provided on the deck of the structure to provide a second phase LNG processing plant, said second phase LNG processing plant having a maximum plant capacity that is higher than the initial plant capacity, wherein the one or more second phase facilities are provided to expand the plant capacity of the first phase LNG processing plant in one or more incremental stages, and, the deck of the structure is sized to provide a pre-allocated space for the installation of the one or more second phase facilities on the deck of the structure.

2. The LNG processing plant of claim 1 wherein the one or more of the plurality of first phase facilities is arranged towards: (a) a first end of the deck with the pre-allocated space being arranged towards a second opposite end of the deck; or (b) a first side of the deck with the pre-allocated space being arranged towards a second opposite side of the deck.

3. (canceled)

4. The LNG processing plant of claim 1 wherein the structure is a fixed structure or a floating structure or a gravity based structure having a base that rests on the seabed at the selected location.

5. The LNG processing plant of claim 1 wherein the structure includes a first cryogenic storage tank for receiving and storing LNG.

6. The LNG processing plant of claim 5 wherein the first cryogenic storage tank is either: (a) a prismatic storage tank; (b) a membrane storage tank; or (c) one of a plurality of first cryogenic storage tanks.

7-11. (canceled)

12. The LNG processing plant of claim 1 wherein the plant has one or both of (a) initial plant capacity of the first phase LNG processing plant is in the range of 0.5 to 7 million tons per annum of LNG; and (b) a maximum capacity after expansion to provide the second phase LNG processing plant in the range of 2 million to 50 million tons per annum of LNG.

13. (canceled)

14. The LNG processing plant of claim 1 wherein one or more of the plurality of first phase facilities is sized for processing both the initial plant capacity and the maximum plant capacity.

15. The LNG processing plant of claim 1 wherein one or more of second phase facilities is located on a fixed platform, a semi-submersible or a jacket structure.

16-17. (canceled)

18. The LNG processing plant of claim 4 wherein the gravity structure includes one or both of a condensate storage tank and an LPG storage tank.

19. The LNG processing plant of claim 1 wherein the structure includes an LNG transfer facility for loading LNG between from the first cryogenic storage tank of the structure to a second cryogenic storage tank onboard an LNG Carrier, or for unloading of LNG from the second cryogenic storage tank of an LNG Carrier to the first cryogenic storage tank of the structure.

20. (canceled)

21. The LNG processing plant of claim 1 wherein the structure is arranged to provide a breakwater for an LNG Carrier at the selected location.

22. The LNG processing plant of any one of the preceding claims wherein the structure is transportable from a first processing location to a second processing location.

23. The LNG processing plant of claim 1 wherein the structure is a gravity based structure and the gravity based structure includes a at least one ballast storage compartment arranged around the periphery of the gravity based structure or arranged toward the base of the gravity based structure, for ballasting.

24. (canceled)

25. The LNG processing plant of claim 1 wherein the LNG processing plant is an LNG production plant arranged to receive a feed stream of natural gas and liquefy the natural gas to produce a product stream of LNG.

26. The LNG processing plant of claim 25 wherein the first phase LNG processing plant includes a first phase gas receiving facility for receiving a hydrocarbon stream comprising hydrocarbon gas and liquids and separating the liquids, including one or both of condensate and free water, from the hydrocarbon stream to produce a hydrocarbon feed gas stream for a gas pre-treatment facility.

27. The LNG processing plant of claim 26 wherein the first phase gas receiving facility is arranged (a) on the deck of the structure; or (b) offshore; or (c) subsea; or (d) onshore.

28-29. (canceled)

30. The LNG processing plant of claim 25 wherein the first phase LNG processing plant includes a first phase gas pre-treatment facility for receiving a hydrocarbon feed gas stream from a gas receiving facility and removing contaminants from the hydrocarbon feed gas stream to produce a stream of pre-treated gas.

31. The LNG processing plant of claim 30 wherein the first phase gas pre-treatment facility is arranged (a) on the deck of the structure; or (b) onshore; or (c) offshore.

32-33. (canceled)

34. The LNG processing plant of claim 25 wherein the first phase LNG processing plant includes a first phase LNG liquefaction facility for receiving the stream of pre-treated gas from a gas pre-treatment facility and liquefying the natural gas to produce a product stream of LNG.

35. The LNG processing plant of claim 34 wherein the first phase LNG liquefaction facility is arranged (a) on the deck of the structure; or (b) onshore; or (c) offshore.

36-37. (canceled)

38. The LNG processing plant of claim 25 wherein the structure includes a boil-off gas reliquefaction facility for liquefying at least a portion of the boil off gas that is generated in first cryogenic storage tank.

39. The LNG processing plant of claim 1 wherein the LNG processing plant is an LNG regasification plant arranged to receive a feed stream of LNG and vaporise the LNG to produce a product stream of natural gas.

40. The LNG processing plant of claim 39 wherein the first phase LNG regasification plant includes a first phase power generation facility for generating a supply of power using a first phase product stream of natural gas as a source of fuel to generate electricity.

41. The LNG processing plant of claim 40 wherein the first phase power generation facility is (a) arranged on the deck of the structure; or (b) arranged onshore; or (c) arranged offshore; or (d) a pre-existing onshore power plant.

42-44. (canceled)

45. The LNG processing plant of claim **39** wherein the first phase LNG regasification plant includes a first phase vaporised gas receiving facility arranged to receive a stream of vaporised natural gas from a first phase regasification facility and send out a first phase product stream of vaporised natural gas.

46. The LNG processing plant of claim **45** wherein the first phase vaporised gas receiving facility is arranged (a) on the deck of the structure; (b) onshore; or (c) offshore.

47-48. (canceled)

49. The LNG processing plant of claim **39** wherein the first phase LNG regasification plant includes a first phase regasification facility arranged to vaporise a first phase feed stream of LNG to produce a first phase stream of vaporised natural gas which is transferred to a first phase vaporised gas receiving facility.

50. The LNG processing plant of claim **49** wherein the first phase regasification facility is arranged (a) on the deck of the structure; or (b) onshore; or (c) offshore.

51-52. (canceled)

53. The LNG processing plant of claim **1** wherein the initial plant capacity is at least 0.5 million tons per year and the maximum feed processing capacity is at least 2 million tons per year.

54. The LNG processing plant of claim **1** wherein the first initial plant capacity is (a) at least 0.5 million tons per year and the maximum feed processing capacity is not greater than 50 million tons per year; or (b) at least 0.5 million tons per year and the maximum feed processing capacity is not greater than 70 million tons per year.

55. (canceled)

56. A method of processing LNG in an LNG processing plant is positioned at a processing location adjacent to a body of water, the method comprising:

A) providing a first phase LNG processing plant for processing an initial plant capacity of LNG, the first phase LNG processing plant comprising a plurality of first phase facilities, each first phase facility having plant equipment related to a pre-determined function associated with the processing of LNG, wherein one or more of the plurality of first phase facilities is arranged on a deck of a structure, wherein the deck is arranged above the level of the water at a selected offshore or near-shore location; and,

B) expanding the plant capacity of the first phase LNG processing plant in one or more incremental stages by providing one or more second phase facilities on the deck of the structure to provide a second phase LNG processing plant, said second phase LNG processing plant having a maximum plant capacity that is higher than the initial plant capacity, wherein the deck of the structure is sized to provide a pre-allocated space for the installation of the one or more second phase facilities on the deck of the structure.

57. The method of claim **56** comprising the step of processing LNG from the first phase LNG processing plant during step B).

58. The method of claim **56** comprising the step of (a) arranging the one or more of the plurality of first phase facilities towards a first end of the deck with the pre-allocated space being arranged towards a second opposite end of the deck; or (b) the one or more of the plurality of first phase facilities towards a first side of the deck with the pre-allocated space being arranged towards a second opposite side of deck.

59-61. (canceled)

62. The method of claim **56** comprising the step of sizing the one or more of the plurality of first phase facilities for processing both the initial plant capacity and the maximum plant capacity.

63-66. (canceled)

67. The method of claim **56** comprising the step of arranging the structure to provide a breakwater for an LNG Carrier at the selected location.

68. The method of claim **56** comprising the step of moving the structure from a first processing location to a second processing location.

69. The method of claim **56** wherein the LNG processing plant is an LNG production plant arranged to receive a feed stream of natural gas and liquefy the natural gas to produce a product stream of LNG.

70. The method of claim **56** wherein the LNG processing plant is an LNG regasification plant arranged to receive a feed stream of LNG and vaporise the LNG to produce a product stream of natural gas.

71-72. (canceled)

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