

# **Safety and Technology Development in LNG Terminals and Vessels**

Report from Study Group D2  
Programme Committee D (LNG)



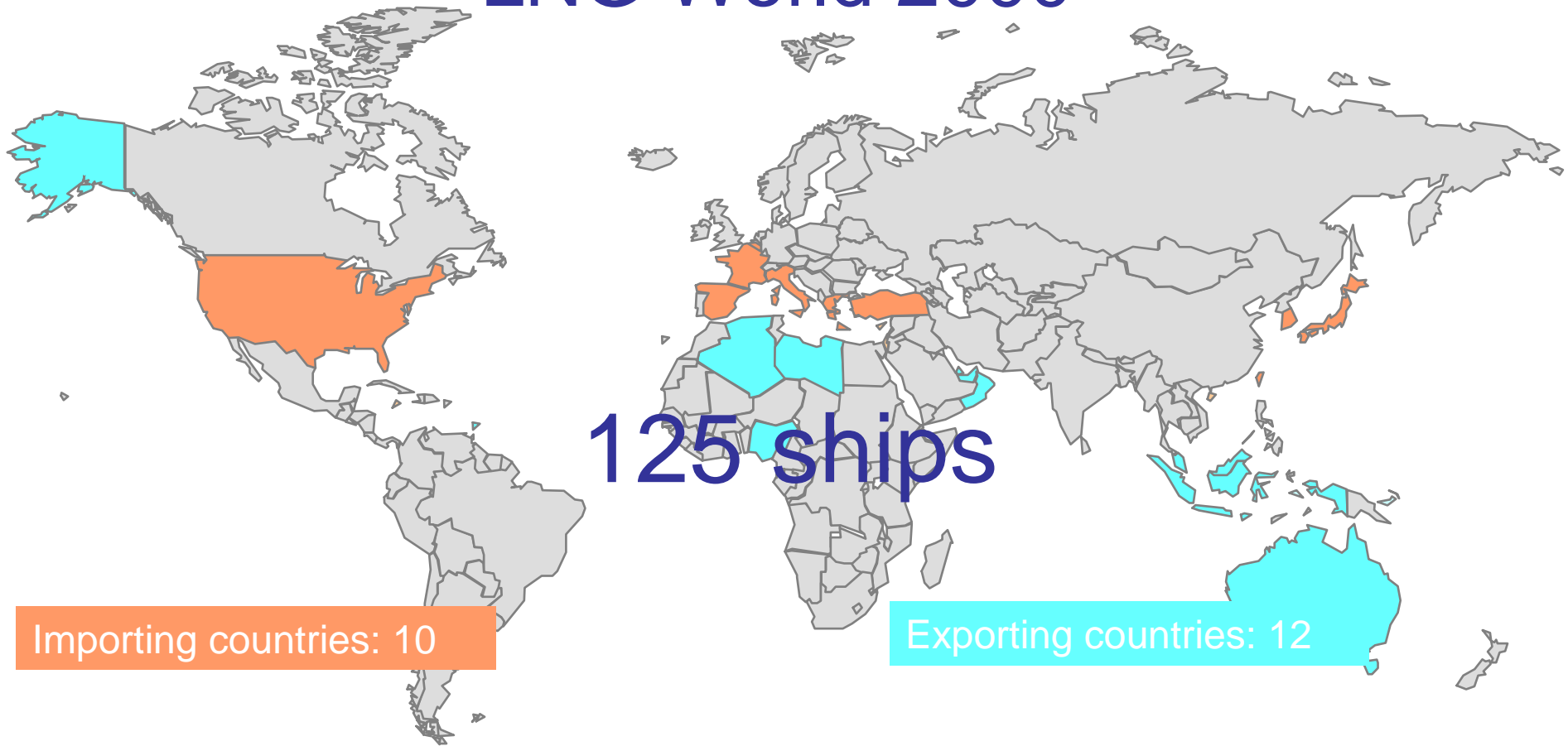
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Amsterdam 5-9 June 2006



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# LNG World 2000



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# LNG World Scenario 2010



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# The Study Group Mandate

- The development of new LNG import and export terminals and LNG vessels meets many environmental hurdles not least the perceived high safety and security risk. Criteria differ from one country to another.
- The efficiency improvements and development in LNG vessel technology and terminal concepts, including very large vessels and offshore regasification terminals, are moving the industry into the future.
- This is the background for the PGC D study group mandate aimed at dealing with safety risk perceptions and support implementation of new technology by the industry. The study group had 18 members from 13 countries representing practically all parts of the LNG chain.



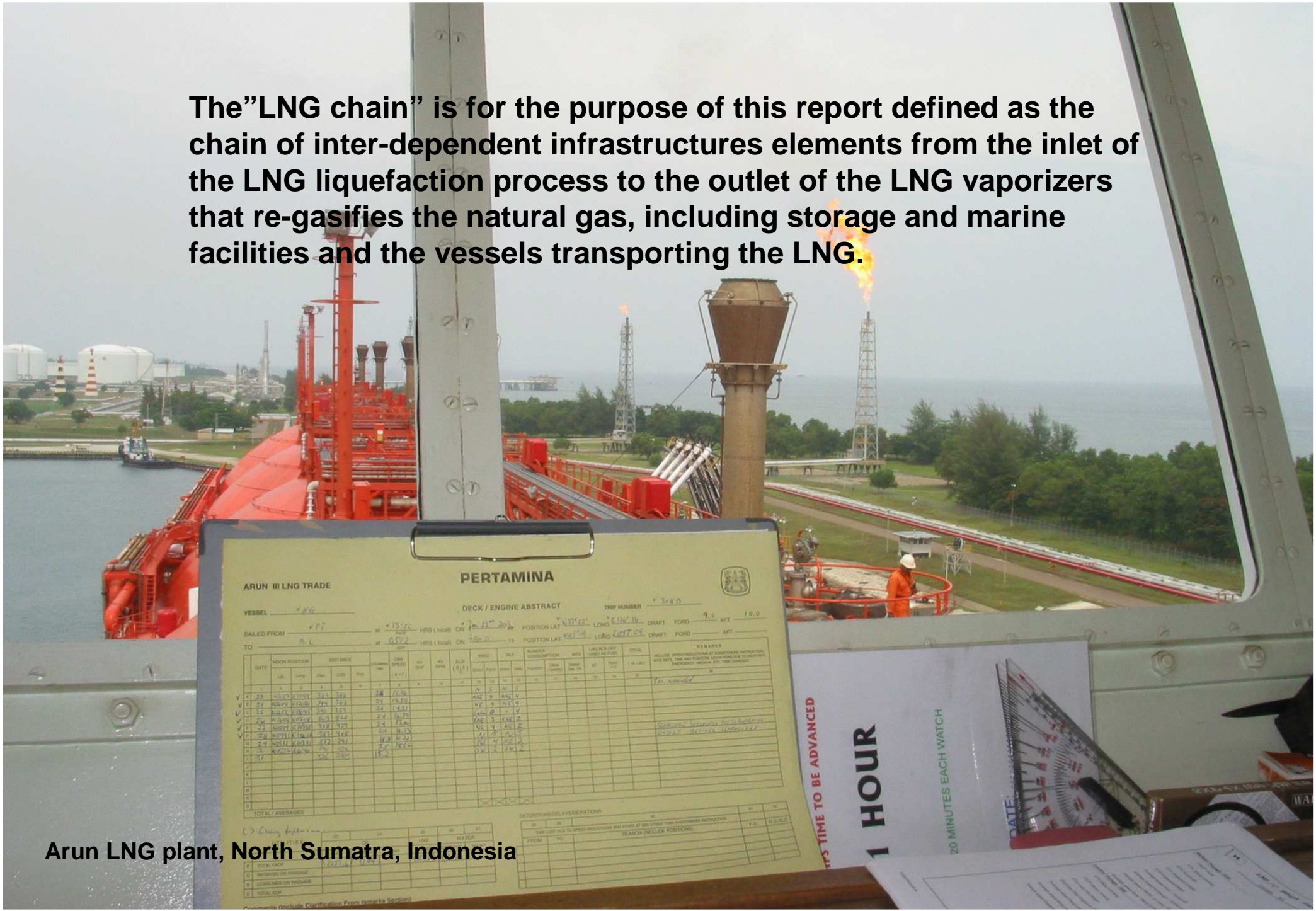
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The "LNG chain" is for the purpose of this report defined as the chain of inter-dependent infrastructures elements from the inlet of the LNG liquefaction process to the outlet of the LNG vaporizers that re-gasifies the natural gas, including storage and marine facilities and the vessels transporting the LNG.



Arun LNG plant, North Sumatra, Indonesia

**PERTAMINA**

DECK / ENGINE ABSTRACT

ARUN III LNG TRADE

VESSEL: 416

TRIP NUMBER: 21010

SAILED FROM: PT AT 13:00 HRS (LOCAL) ON 20/01/2011 POSITION LAT: 01° 42' N LONG: 103° 10' E DRAFT: 9.0 MET

TO: PL AT 05:22 HRS (LOCAL) ON 20/01/2011 POSITION LAT: 01° 42' N LONG: 103° 10' E DRAFT: 9.0 MET

DATE	MOON POSITION		DISTANCE	SPEED	WIND	SEA	WAVE	TEMP	HUMID	PRESS	VISIB	CLOUD	REMARKS
	LAT	LONG											
1													
2	01° 42' N	103° 10' E	11.5	14	10	2	28	75	85	1010	10	10	SEA CALM
3	01° 42' N	103° 10' E	11.5	14	10	2	28	75	85	1010	10	10	SEA CALM
4	01° 42' N	103° 10' E	11.5	14	10	2	28	75	85	1010	10	10	SEA CALM
5	01° 42' N	103° 10' E	11.5	14	10	2	28	75	85	1010	10	10	SEA CALM
6	01° 42' N	103° 10' E	11.5	14	10	2	28	75	85	1010	10	10	SEA CALM
7	01° 42' N	103° 10' E	11.5	14	10	2	28	75	85	1010	10	10	SEA CALM
8	01° 42' N	103° 10' E	11.5	14	10	2	28	75	85	1010	10	10	SEA CALM
9	01° 42' N	103° 10' E	11.5	14	10	2	28	75	85	1010	10	10	SEA CALM
10	01° 42' N	103° 10' E	11.5	14	10	2	28	75	85	1010	10	10	SEA CALM
11	01° 42' N	103° 10' E	11.5	14	10	2	28	75	85	1010	10	10	SEA CALM
12	01° 42' N	103° 10' E	11.5	14	10	2	28	75	85	1010	10	10	SEA CALM
13	01° 42' N	103° 10' E	11.5	14	10	2	28	75	85	1010	10	10	SEA CALM
14	01° 42' N	103° 10' E	11.5	14	10	2	28	75	85	1010	10	10	SEA CALM
15	01° 42' N	103° 10' E	11.5	14	10	2	28	75	85	1010	10	10	SEA CALM
16	01° 42' N	103° 10' E	11.5	14	10	2	28	75	85	1010	10	10	SEA CALM
17	01° 42' N	103° 10' E	11.5	14	10	2	28	75	85	1010	10	10	SEA CALM
18	01° 42' N	103° 10' E	11.5	14	10	2	28	75	85	1010	10	10	SEA CALM
19	01° 42' N	103° 10' E	11.5	14	10	2	28	75	85	1010	10	10	SEA CALM
20	01° 42' N	103° 10' E	11.5	14	10	2	28	75	85	1010	10	10	SEA CALM
21	01° 42' N	103° 10' E	11.5	14	10	2	28	75	85	1010	10	10	SEA CALM
22	01° 42' N	103° 10' E	11.5	14	10	2	28	75	85	1010	10	10	SEA CALM
23	01° 42' N	103° 10' E	11.5	14	10	2	28	75	85	1010	10	10	SEA CALM
24	01° 42' N	103° 10' E	11.5	14	10	2	28	75	85	1010	10	10	SEA CALM
25	01° 42' N	103° 10' E	11.5	14	10	2	28	75	85	1010	10	10	SEA CALM
26	01° 42' N	103° 10' E	11.5	14	10	2	28	75	85	1010	10	10	SEA CALM
27	01° 42' N	103° 10' E	11.5	14	10	2	28	75	85	1010	10	10	SEA CALM
28	01° 42' N	103° 10' E	11.5	14	10	2	28	75	85	1010	10	10	SEA CALM
29	01° 42' N	103° 10' E	11.5	14	10	2	28	75	85	1010	10	10	SEA CALM
30	01° 42' N	103° 10' E	11.5	14	10	2	28	75	85	1010	10	10	SEA CALM
31	01° 42' N	103° 10' E	11.5	14	10	2	28	75	85	1010	10	10	SEA CALM
TOTAL AVERAGES													

DEVIATIONS DELA PASSEVATIONS

DATE: \_\_\_\_\_

**IT'S TIME TO BE ADVANCED**

**1 HOUR**

20 MINUTES EACH WATCH

DATE: \_\_\_\_\_



LNG/C Matthew at the Neptune LNG  
Deepwater Port Terminal site in  
Massachusetts Bay

**The study covers recent technology developments. Many of these developments carry not only an economical advantage as their driving force, but have new additional safety, security and environmental reasons for being pursued.**

# Study Group Report: Technology Development

## **2 TECHNOLOGY DEVELOPMENTS IN EXPORT TERMINALS**

- 2.1 Liquefaction process
- 2.2 Storage
- 2.3 LNG transfer
- 2.4 Offshore terminals
- 2.5 Environmental issues

## **3 TECHNOLOGY DEVELOPMENTS IN LNG CARRIERS**

- 3.1 Larger vessel designs
  - 3.2 Hull
  - 3.4 LNG Reliquefaction
  - 3.5 Environmental issues
- Appendix 6: Containment Systems  
Appendix 7: Propulsion systems  
Appendix 8: LNG Reliquefaction onboard LNG carriers

## **4 TECHNOLOGY DEVELOPMENTS IN IMPORT TERMINALS**

- 4.1 Onshore terminals
- 4.2 Offshore gravity based structures
- 4.3 Regasification vessels solutions
- 4.4 Environmental issues



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**The development frontier is being pushed with the increase in LNG carrier size. The largest to be built is currently 153 000 cubic meters. Soon we will see ships capable of carrying more than 200 000 cubic meters of LNG.**



**Arctic Lady, 147 000 cubic meters,  
the worlds largest LNG carrier to date**



# Study Group report: Safety

## 5 STANDARDS

## 6 SAFETY – EXPORT AND IMPORT TERMINALS

## 7 SAFETY - LNG TRANSFER

## 8 SAFETY - LNG CARRIER

8.2 Sea staff training

8.3 Best operational practices

8.4 Port operations

## 9 SECURITY

Appendix 1: Safety Questionnaire

Appendix 2: Available Legislation and Recommendations Information



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**In collaboration with the Society of International Gas Tanker and Terminal Operators (SIGTTO), IGU conducted a survey of standards and guidelines used at LNG production, transportation and receiving facilities world-wide.**

**The results have demonstrated a high level of knowledge and compliance which indicate a well, but not over, regulated industry which takes a pride in its achievements and record of safety.**

**Snøhvit LNG plant, Hammerfest, Northern Norway**



# Standards and Safety in LNG Terminals and Vessels

- The study group has made a concerted effort to establish an overview of the standards, recommendations and rules and legislation throughout the LNG chain in order to identify gaps.
- Areas not covered by adequate standards and rules are exposed to widely variable operating practices and should be addressed to encourage best practice and uniform operating environments.
- Accidents at two liquefaction plants have raised safety concerns.
- The number of (minor) vessel incidents has increased.



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# Security

## International Maritime Organisation INTERNATIONAL SHIP AND PORT SECURITY CODE (ISPS)



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# Safety and Security

- Safety and security in the LNG chain can not be looked upon as segregated regional or commercial concerns. It is something that effects the whole LNG industry, directly or indirectly, everywhere and in all parts of the chain. The LNG industry must address this to move forward.
- We must educate, inform and hopefully influence decision makers on issues that concern the industry as a whole.
- In addition to the IGU study group, a number of initiatives have recently been undertaken to address and study safety and security issues.



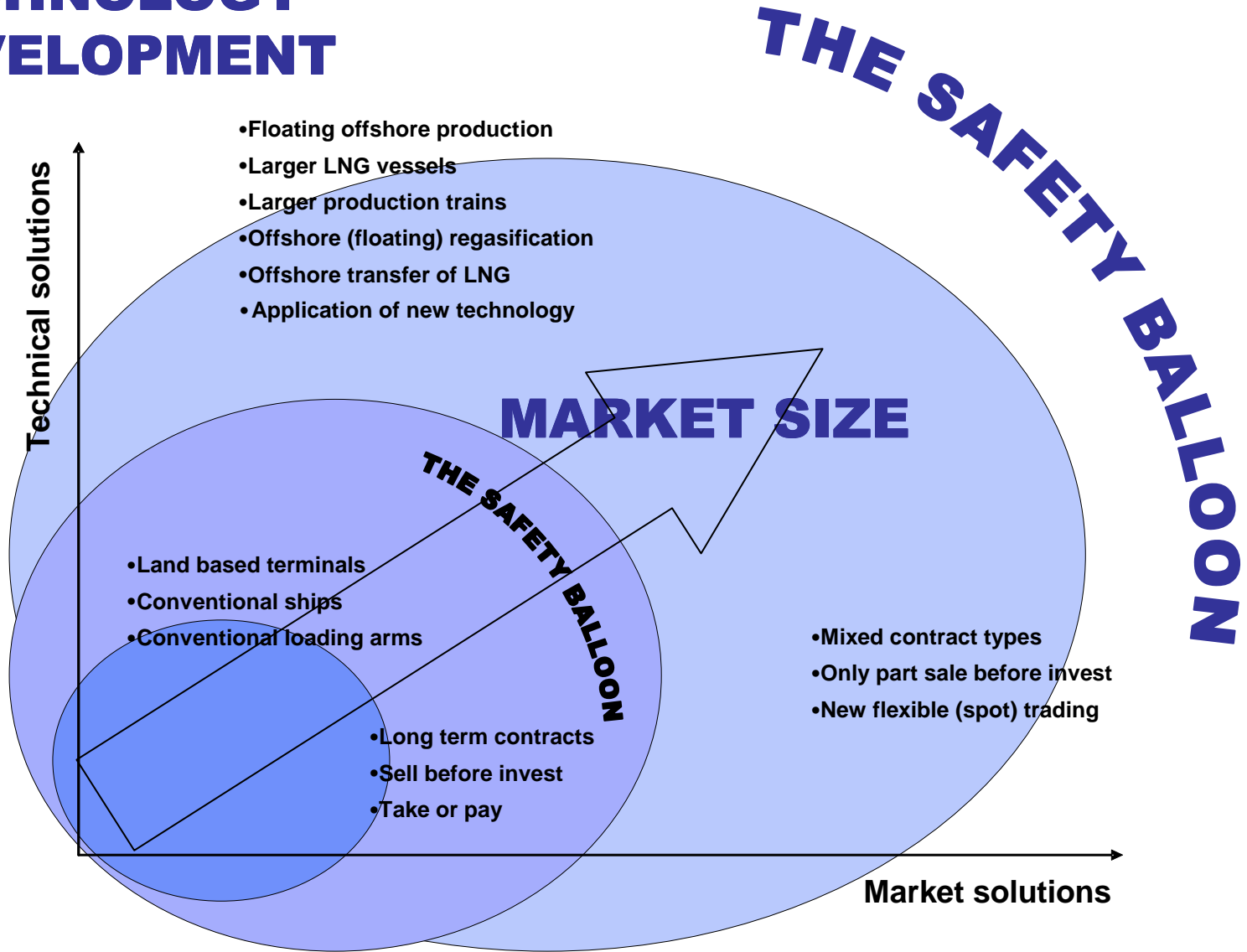
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# TECHNOLOGY DEVELOPMENT



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**THANK YOU FOR YOUR ATTENTION**



**Programme Committee D (LNG) visiting the Snøhvit LNG Plant  
at Melkøya Island outside Hammerfest, Northern Norway, October 2005**