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June 17–22, Rhodes (Rodos), Greece

The Twenty-second (2012) International  
**Offshore and Polar  
Engineering Conference**

*In addition ISOPE specialty symposia:*

- 1st Tsunami & Safety
- 1st Asset Integrity
- 3rd Arctic Science & Technology
- 2nd Arctic Materials
- 3rd Renewable Energy & Environment
- 4th Sloshing Dynamics & Design
- 4th Frontier & Clean Energy Tech
- 10th High-Performance Materials
- 5th Strain-Based Design

**ISOPE-2012**

Rodos Palace Hotel, Rhodes, Greece, June 17–22

## Technical Program

Refereed papers from **52** countries in **150** technical general  
Plenary and keynote presentations  
General Information, Reservations, Publications and Program  
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Forms for Advance Registration and Venue Hotel:  
Inside this program and on [www.isopec.org](http://www.isopec.org) [www.isopec2012.org](http://www.isopec2012.org)

*Organized by:*  
Technical Program Committee, ISOPE

*Sponsored by:*  
International Society of Offshore and Polar Engineers (ISOPE)  
with cooperating organizations (listed inside)



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ISOPE Awards, Scholarship, and Student Forum:  
Presentation at Banquet



Conference Opening Session



Annual Conference Banquet

More photos on [www.isopec.org](http://www.isopec.org) and [www.isopec2012.org](http://www.isopec2012.org)  
ISOPE-2011 Maui

21st Annual International Ocean and Polar Engineering  
Conference, Maui, June 19-24, 2011

## Welcome to ISOPE-2012 Conference

We greatly appreciate the excellent responses with **1250+** abstracts and help we have received from colleagues around the world in the successful organization of the 22nd International Offshore and Polar Engineering Conference (ISOPE-2012), Rhodes, Greece, June 17–22, 2012. The Conference features **150** sessions of *peer-reviewed* papers and **8** keynote presentations from more than **52 countries**, including the ISOPE specialty symposia as a part of the ISOPE-2012 Conference.

The conference program is issued in 2 versions: Printed and internet ([www.isopec.org](http://www.isopec.org) and [www.isopec2012.org](http://www.isopec2012.org)). To meet the page limit, only the first author data are listed in the printed version, and the internet version lists all authors.

The purposes of the ISOPE conference are to:

- \* Promote technological progress and activities, international technological transfer and cooperation, and opportunities for engineers to maintain and improve technical competence; and
- \* Provide a timely international forum for technical activities, cooperation, opportunity and fellowship among researchers and engineers by developing focused session topics with high quality papers (in both originality and significance) accepted through rigorous review, establishing high international standards for publication and worldwide distribution and promoting interdisciplinary interaction between academia and industry.

The International Society of Offshore and Polar Engineers (ISOPE) has already held **49 successful international meetings** with peer-reviewed papers:

- 1st (1990) European Offshore Mechanics Symposium (**EUROMS-90**) Trondheim; EUROMS-99 Moscow;
- 1st (1990) Pacific/Asia Offshore Mechanics Symposium (**PACOMS-90**) Seoul; PACOMS-94 Beijing; 1996 Pusan, 2002 Daejeon, 2004 Vladivostok, 2006 Dalian, 2008 Bangkok, 2010 Busan
- Annual **ISOPE** conferences, starting in Edinburgh, 1991 were held in San Francisco, Singapore, Osaka, The Hague, Los Angeles, Honolulu, Montréal, Brest, Seattle, Stavanger, Kitakyushu, Honolulu, Toulon, Seoul, San Francisco, Lisbon, Vancouver, Osaka, Beijing and Maui. Since 1992, the annual ISOPE conference program has been the world's largest of its kind with peer-reviewed papers;
- 1st (1995) ISOPE Ocean Mining Symposium (**OMS-95**), Tsukuba, 1995, Seoul, Goa, Szczecin, Tsukuba, Changsha, Lisbon; Chennai
- 1st (1996) International Deep-Ocean Technology (**IDOT-96**) Symposium and Workshop, 1996 Los Angeles; 2001 Stavanger and 2009 Beijing;
- ISOPE **HPM** Symposium: Honolulu 2003, Toulon 2004, Seoul 2005, San Francisco 2006, Lisbon 2007, Vancouver 2008; Osaka 2009 and Beijing 2010 ;
- ISOPE Series of specialty symposia : **ANGT**: Seoul 2005-; **Strain-Based Design SBD**: Lisbon 2007-; **Nanotechnology NANOS**: Lisbon 2007 Frontier Energy; **Sloshing Dynamics, Sloshing-2009-**, **Renewable Energy/Environment, REES-2010**; Arctic Science & Tech, **Arctic-2010-**; **Arctic Materials-2011-**; **Asset Integrity-2012-**

On behalf of the Technical Program Committee, it is our pleasure to welcome participants from all over the world to the ISOPE-2012 Conference in Rhodes, Greece.

|                       |                           |                            |
|-----------------------|---------------------------|----------------------------|
| Jin S Chung,<br>USA   | Demos Angelides<br>Greece | Ronald H Knapp<br>USA      |
| Xizhao Jiang<br>China | Shigeru Naito<br>Japan    | Michael Isaacson<br>Canada |

Co-chairmen of the ISOPE-2012 Conference

**SUNDAY JUNE 17**

09:00 ISOPE Board of Directors Meeting Executive D  
10:30 ISOPE-2010 Executive Committee Meeting Executive D  
EUROMS and PACOMS Executive Committees  
15:00-18:00  
**CONFERENCE REGISTRATION** Lobby  
17:00-18:00  
**WELCOME RECEPTION** Outdoor Pool Garden  
Tour Information Visit tour desk in ISOPE registration area:  
[www.isopec.org](http://www.isopec.org)  
Spouse Program Join Tour program: see [www.isopec.org](http://www.isopec.org)

**MONDAY June 18**

**On-Site Registration** starts at 07:30 Lobby  
**07:30 Session Chair/Co-chair Briefing** Lobby  
  
**08:30 Conference Opening** Jupiter  
08:30  
**1. OCEAN AND ENERGY INDUSTRY REVIEW—2011** Jupiter  
  
**10:30**  
**2. LNG SLOSHING I: GTT Progress** Room 1  
**3. VORTEX-INDUCED VIBRATIONS I** Room 2  
**4. RENEWABLE ENERGY I: Wind 1: Foundations 1** Room 3  
**5. TSUNAMI I: 2011 Tohoku Tsunami 1** Room 4  
**6. ASSET INTEGRITY I** Room 5  
**7. ENVIRONMENT I: Oil Spill and Emission** Room 6  
**8. SBD I: Materials** Room 7  
**9. FRONTIER ENERGY I: Clean Energy** Room 8  
**10. RISK & RELIABILITY I** Room 9  
**11. UNDERSEA I: Operation and Communication 1** Room 10  
  
**14:00**  
**12. LNG SLOSHING II: Physics & Coupling** Room 1  
**13. VORTEX-INDUCED VIBRATIONS II** Room 2  
**14. RENEWABLE ENERGY II: Wind 2: Foundations 2** Room 3  
**15. TSUNAMI II: 2011 Tohoku Tsunami 2** Room 4  
**16. ASSET INTEGRITY II** Room 5  
**17. ENVIRONMENT II: Physical & Chemical Processes** Room 6  
**18. SBD II: Numerical Modeling** Room 7  
**19. FRONTIER ENERGY II: Clean Coal** Room 8  
**20. RISK & RELIABILITY II** Room 9  
**21. UNDERSEA II: Operation and Communication 2** Room 10  
  
**16:20**  
**22. LNG SLOSHING III: LNG Tank Design 1** Room 1  
**23. HYDRODYNAMICS I: MetOcean 1** Room 2  
**24. RENEWABLE ENERGY III: Wind 3: Substructures** Room 3  
**25. TSUNAMI III: Generation & Warning 1** Room 4  
**26. ASSET INTEGRITY III** Room 5  
**27. ENVIRONMENT III: Water & Sediment Qualities** Room 6  
**28. SBD III: Strain Capacity Characterization** Room 7  
**29. FRONTIER ENERGY III: Hydrate Fundamental** Room 8  
**30. RISK & FATIGUE** Room 9  
**31. UNDERSEA III: Vehicle and Control 1** Room 10  
  
**18:30** Find from the bulletin board  
**ISOPE Technical Committee Meetings**

**Tuesday June 19**

|              |   |                    |
|--------------|---|--------------------|
| <b>07:30</b> | <b>Session Chair/Co-chair Briefing</b>  | <b>Lobby</b>       |
| <b>08:00</b> |   |                    |
| 32.          | LNG SLOSHING IV: LNG Tank Design 2  | Room 1             |
| 33.          | HYDRODYNAMICS II: MetOcean 2  | Room 2             |
| 34.          | RENEWABLE ENERGY IV: Wind 4: Dynamics 1   | Room 3             |
| 35.          | TSUNAMI IV: Generation & Warning 2  | Room 4             |
| 36.          | ASSET INTEGRITY IV  | Room 5             |
| 37.          | COASTAL I:Waves & Modeling 1  | Room 6             |
| 38.          | SBD IV: Fracture Mechanics  | Room 7             |
| 39.          | FRONTIER ENERGY IV: Hydrate Development   | Room 8             |
| 40.          | OFFSHORE MECHANICS I: Floating Dynamics 1   | Room 9             |
| 41.          | UNDERSEA IV: Vehicle and Control 2  | Room 10            |
| <b>10:30</b> |   |                    |
| 42.          | LNG SLOSHING V: Sloshing Tests  | Room 1             |
| 43.          | HYDRODYNAMICS III: MetOcean 3   | Room 2             |
| 44.          | RENEWABLE ENERGY V: Wind 5: Floating 1  | Room 3             |
| 45.          | TSUNAMI V: Generation & Warning 3   | Room 4             |
| 46.          | ADVANCED SHIP TECH I: Ultimate Strength   | Room 5             |
| 47.          | COASTAL II: Waves & Modeling 2  | Room 6             |
| 48.          | SUBSEA, PIPELINES, RISERS I: NORD Stream  | Room 7             |
| 49.          | FRONTIER ENERGY V: Hydrate Modeling   | Room 8             |
| 50.          | OFFSHORE MECHANICS II: Floating Dynamics 2  | Room 9             |
| 51.          | ARCTIC MATERIALS I  | Room 10            |
| <b>13:00</b> |   |                    |
|              | <b>Chung Award Lecture</b>  | <b>Room 2</b>      |
| <b>14:00</b> |   |                    |
| 52.          | LNG SLOSHING VI: CFD  | Room 1             |
| 53.          | HYDRODYNAMICS IV: Freak and Long Waves  | Room 2             |
| 54.          | RENEWABLE ENERGY VI: Wind 6: Floating 2   | Room 3             |
| 55.          | TSUNAMI VI: Propagation & Flooding  | Room 4             |
| 56.          | ADVANCED SHIP TECH II: At-Sea Explosions  | Room 5             |
| 57.          | COASTAL III: Waves & Modeling 3   | Room 6             |
| 58.          | SUBSEA, PIPELINES, RISERS II: New Concept Develop.  | Room 7             |
| 59.          | GEOTECH I: Suction Piles  | Room 8             |
| 60.          | OFFSHORE MECHANICS III: Systems I   | Room 9             |
| 61.          | ARCTIC MATERIALS II   | Room 10            |
| <b>16:20</b> |   |                    |
| 62.          | LNG SLOSHING VII: Structural Responses  | Room 1             |
| 63.          | HYDRODYNAMICS V: Wave Loading   | Room 2             |
| 64.          | RENEWABLE ENERGY VII: Wind 7: Analysis Tools  | Room 3             |
| 65.          | TSUNAMI VII: Structure & Sediment 1   | Room 4             |
| 66.          | HPM I: Adv Materials & Structures 1   | Room 5             |
| 67.          | COASTAL IV: Breakwaters & Waves 1   | Room 6             |
| 68.          | SUBSEA, PIPELINES, RISERS III: Panel  | Room 7             |
| 69.          | GEOTECH II: Offshore Foundations  | Room 8             |
| 70.          | OFFSHORE MECHANICS IV: Systems II   | Room 9             |
| 71.          | ARCTIC I: Navigation in Pack Ice  | Room 10            |
| <b>15:30</b> | <b>Awards Committee Meeting</b>   | <b>Executive D</b> |
| <b>16:30</b> | <b>Board of Editors Meeting</b>   | <b>Executive D</b> |
| <b>18:00</b> | <b>Student Forum (advance reservation to <a href="mailto:isope-2@isope-org">isope-2@isope-org</a> )</b> |                    |

**WEDNESDAY JUNE 20**

|              |  |                    |
|--------------|--|--------------------|
| <b>07:30</b> | <b>Session Chair/Co-chair Briefing</b>           | <b>Lobby</b>       |
| <b>08:00</b> |  |                    |
| 72.          | RENEWABLE ENERGY XVI: Wave 4                     | Room 1             |
| 73.          | HYDRODYNAMICS VI: Floating-Body Dynamics 1       | Room 2             |
| 74.          | RENEWABLE ENERGY VIII: Wind 8: Concepts          | Room 3             |
| 75.          | TSUNAMI VIII: Structure & Sediment 2             | Room 4             |
| 76.          | HPM II: Adv Materials & Structures 2             | Room 5             |
| 77.          | COASTAL V: Breakwaters & Waves 2                 | Room 6             |
| 78.          | SUBSEA, PIPELINES, RISERS IV: Improved Perform.  | Room 7             |
| 79.          | GEOTECH III: Soil Improvement                    | Room 8             |
| 80.          | FRONTIER ENERGY VI: Ocean Mining 1: Minerals     | Room 9             |
| 81.          | ARCTIC II: Ice Mechanics                         | Room 10            |
| <b>10:30</b> |  |                    |
| 82.          | RENEWABLE ENERGY XVII: Wave 5                    | Room 1             |
| 83.          | HYDRODYNAMICS VII: Floating-Body Dynamics 2      | Room 2             |
| 84.          | RENEWABLE ENERGY IX: Wind 9: Codes & Design      | Room 3             |
| 85.          | TSUNAMI IX: Risk Assessment 1                    | Room 4             |
| 86.          | HPM III: Composites                              | Room 5             |
| 87.          | COASTAL VI: Breakwaters & Waves 3                | Room 6             |
| 88.          | SUBSEA, PIPELINES, RISERS V: Component Develop   | Room 7             |
| 89.          | GEOTECH IV: Cyclic Loading                       | Room 8             |
| 90.          | FRONTIER ENERGY VII: Ocean Mining 2: Systems     | Room 9             |
| 91.          | ARCTIC III: Coastal Arctic Properties            | Room 10            |
| <b>12:00</b> | <b>ISOPE Board of Directors Meeting</b>          | <b>Executive D</b> |
| <b>13:15</b> | <b>Plenary Presentation: Pipeline</b>            | <b>Room 1</b>      |
| <b>14:00</b> |  |                    |
| 92.          | RENEWABLE ENERGY XVIII: Wave 6: Resources        | Room 1             |
| 93.          | HYDRODYNAMICS VIII: Floating-Body Dynamics 3     | Room 2             |
| 94.          | RENEWABLE ENERGY X: Wind 10: Resources           | Room 3             |
| 95.          | TSUNAMI X: Risk Assessment 2                     | Room 4             |
| 96.          | HPM IV: Fatigue & Fracture 1                     | Room 5             |
| 97.          | COASTAL VII: Wave-Structure Interaction          | Room 6             |
| 98.          | SUBSEA, PIPELINES, RISERS VI: Fatigue Assessment | Room 7             |
| 99.          | GEOTECH V: Slope Stability                       | Room 8             |
| 100.         | OFFSHORE MECHANICS V: Deepwater Installation     | Room 9             |
| 101.         | ARCTIC IV: Ice Environment & Forecasting         | Room 10            |
| <b>16:20</b> |  |                    |
| 102.         | RENEWABLE ENERGY XIX: Tidal & Current 1          | Room 1             |
| 103.         | HYDRODYNAMICS XIII: DP & Control                 | Room 2             |
| 104.         | RENEWABLE ENERGY XI: Wind 11: Power 4            | Room 3             |
| 105.         | ADVANCED SHIP TECH III: Collision & Vibration    | Room 4             |
| 106.         | HPM V: Fatigue & Fracture 2                      | Room 5             |
| 107.         | COASTAL VIII: Estuary Hydraulics                 | Room 6             |
| 108.         | SUBSEA, PIPELINES, RISERS VII: Adv Analysis 1    | Room 7             |
| 109.         | GEOTECH VI: Piles & Foundations                  | Room 8             |
| 110.         | OFFSHORE MECHANICS VI: Design & Installation     | Room 9             |
| 111.         | LNG SLOSHING VIII: Panel                         | Room 10            |

|  |                        |
|--|------------------------|
| <b>19:00</b>   | <b>Super Dome Pool</b> |
| <b>Annual Conference Banquet</b>   |                        |
| 22nd ISOPE Cultural Event, Best Paper, Best Student Paper, Outstanding Students and Awards |                        |
| <i>Don't forget the banquet ticket.</i>  |                        |

**THURSDAY JUNE 21**

**07:30 Session Chair/Co-chair Briefing** **Lobby**

**08:00**

|  |         |
|--|---------|
| 112. RENEWABLE ENERGY XX: Tidal & Current 2            | Room 1  |
| 113. HYDRODYNAMICS IX: CFD 1                           | Room 2  |
| 114. RENEWABLE ENERGY XII: Wind 12:                    | Room 3  |
| 115. ADVANCED SHIP TECH IV: Slamming & Load            | Room 4  |
| 116. HPM VI: Fatigue & Fracture 3                      | Room 5  |
| 117. COASTAL IX: Coastal Sediment 1                    | Room 6  |
| 118. SUBSEA, PIPELINES, RISERS VIII: Install. & Fabric | Room 7  |
| 119. GEOTECH VII: Consolidation & Seepage              | Room 8  |
| 120. OFFSHORE MECHANICS VII: Moored Structures         | Room 9  |
| 121. ARCTIC V: Ice Structure Interaction               | Room 10 |

**10:30**

|   |         |
|---|---------|
| 122. RENEWABLE ENERGY XXI: Tidal & Current 3  | Room 1  |
| 123. HYDRODYNAMICS X: CFD 2                   | Room 2  |
| 124. RENEWABLE ENERGY XIII: Wave 1            | Room 3  |
| 125. ADVANCED SHIP TECH V: Propulsion         | Room 4  |
| 126. HPM VII: Shipbuilding Steels             | Room 5  |
| 127. COASTAL X: Coastal Sediment 2            | Room 6  |
| 128. SUBSEA, PIPELINES, RISERS IX: Analysis 2 | Room 7  |
| 129. GEOTECH VIII: Material Testing           | Room 8  |
| 130. OFFSHORE MECHANICS VIII: FSRU 1          | Room 9  |
| 131. ARCTIC VI: Operations in Ice)            | Room 10 |

**12:00 Ocean Mining Executive Committee** **Executive D**

**14:00**

|   |         |
|---|---------|
| 132. RENEWABLE ENERGY XXII: Thermal Energy      | Room 1  |
| 133. HYDRODYNAMICS XI: CFD 3                    | Room 2  |
| 134. RENEWABLE ENERGY XIV: Wave 2               | Room 3  |
| 135. ADVANCED SHIP TECH VI: System design       | Room 4  |
| 136. HPM VIII: Advances in Welding Technology 1 | Room 5  |
| 137. COASTAL XI: Coastal Sediment 3             | Room 6  |
| 138. SUBSEA, PIPELINES, RISERS X: Flow Effects  | Room 7  |
| 139. GEOTECH IX: Soil Properties                | Room 8  |
| 140. OFFSHORE MECHANICS IX: FSRU 2              | Room 9  |
| 141. ARCTIC VII: Ice Modeling & Operations      | Room 10 |

**16:20**

|   |        |
|---|--------|
| 142. RENEWABLE ENERGY XXIII: Marine Bioenergy       | Room 1 |
| 143. HYDRODYNAMICS XII: CFD 4                       | Room 2 |
| 144. RENEWABLE ENERGY XV: Wave 3                    | Room 3 |
| 145. ADVANCED SHIP TECH VII: Seakeeping & Resist.   | Room 4 |
| 146. HPM IX: Advances in Welding Technology 2       | Room 5 |
| 147. COASTAL XII: Storm Surge & Inundation          | Room 6 |
| 148. SUBSEA, PIPELINES, RISERS XI: System Integrity | Room 7 |
| 149. GEOTECH X: Construction & Materials            | Room 8 |
| 150. OFFSHORE MECHANICS X: LNG Transport            | Room 9 |

|                                      |                          |
|--------------------------------------|--------------------------|
| <b>Sunday – Thursday</b>             |                          |
| <a href="#">Author Practice</a>      | Individual session rooms |
| <a href="#">On-site Registration</a> | Lobby                    |
| <a href="#">ISOPE Headquarters</a>   | VIP Lounge               |
| <a href="#">Proceedings Pickup</a>   | Registration Desk, Lobby |
| <a href="#">Committee Meetings</a>   | Executive D, Mezzanine e |

**FRIDAY June 22**

Find Updates in Program on [www.isopec.org](http://www.isopec.org) and [www.isopec2012.org](http://www.isopec2012.org)  
Tours: Click on [General Information](#)

**ISOPE-2012 Rhodes**  
**The Twenty-second (2012) International**  
**Offshore and Polar Engineering Conference**  
Rhodes, Greece, June 17–22, 2012

This 22nd annual conference features **150 technical and opening general sessions**, **1 plenary presentation** and **4 keynote presentations** with top experts from industry, academia and government. After peer review of the manuscripts selected from 1,250+ abstracts, some **720** peer-reviewed papers will be presented and discussed by researchers, engineers and managers from more than **52** countries.

The conference proceedings of peer-reviewed papers in PDF files will be available in a set of 4 volumes on CD-ROM (4,200 pp. est.) — paginated within each volume — during the conference and later for worldwide post-conference mail order from ISOPE: **ISBN 978-1-880653-94-4; ISSN 1098-6189**.

The number at end of the session title indicates the tentative number of the proceedings volume. Only the changes on titles or authors the Technical Program Committee received in writing before January 19, 2012 are reflected in this program. Final corrections will be updated in the Conference Proceedings of peer-reviewed papers and the Final Program.

**All ISOPE publications are indexed by Engineering Index (EI).**

**SESSION LIST BY TOPICS**

**OCEAN AND ENERGY INDUSTRY REVIEW (V. 1)**

**1. OCEAN AND ENERGY INDUSTRY REVIEW—2011** Jupiter

**FRONTIER ENERGY, GAS HYDRATES & OCEAN MINING (V. 1)**

|   |        |
|---|--------|
| <b>9. FRONTIER ENERGY I: Clean Energy</b>               | Room 8 |
| <b>19. FRONTIER ENERGY II: Clean Coal</b>               | Room 8 |
| <b>29. FRONTIER ENERGY III: Hydrate Fundamental</b>     | Room 8 |
| <b>39. FRONTIER ENERGY IV: Hydrate Development</b>      | Room 8 |
| <b>49. FRONTIER ENERGY V: Hydrate Modeling</b>          | Room 8 |
| <b>80. FRONTIER ENERGY VI: Ocean Mining 1: Minerals</b> | Room 9 |
| <b>90. FRONTIER ENERGY VII: Ocean Mining 2: Systems</b> | Room 9 |

**RENEWABLE ENERGY (OFFSHORE WIND AND OCEAN)  
AND ENVIRONMENT (V. 1)**

|  |        |
|--|--------|
| <b>4. RENEWABLE ENERGY I: Wind 1: Foundations 1</b>        | Room 3 |
| <b>14. RENEWABLE ENERGY II: Wind 2: Foundations 2</b>      | Room 3 |
| <b>24. RENEWABLE ENERGY III: Wind 3: Substructures</b>     | Room 3 |
| <b>34. RENEWABLE ENERGY IV: Wind 4: Dynamics 1</b>         | Room 3 |
| <b>44. RENEWABLE ENERGY V: Wind 5: Floating 1</b>          | Room 3 |
| <b>54. RENEWABLE ENERGY VI: Wind 6: Floating 2</b>         | Room 3 |
| <b>64. RENEWABLE ENERGY VII: Wind 7: Analysis Tools</b>    | Room 3 |
| <b>74. RENEWABLE ENERGY VIII: Wind 8: Concepts</b>         | Room 3 |
| <b>84. RENEWABLE ENERGY IX: Wind 9: Codes &amp; Design</b> | Room 3 |
| <b>94. RENEWABLE ENERGY X: Wind 10: Resources</b>          | Room 3 |
| <b>104. RENEWABLE ENERGY XI: Wind 11: Power 4</b>          | Room 3 |
| <b>114. RENEWABLE ENERGY XII: Wind 12:</b>                 | Room 3 |
| <b>124. RENEWABLE ENERGY XIII: Wave 1</b>                  | Room 3 |
| <b>134. RENEWABLE ENERGY XIV: Wave 2</b>                   | Room 3 |
| <b>144. RENEWABLE ENERGY XV: Wave 3</b>                    | Room 3 |
| <b>72. RENEWABLE ENERGY XVI: Wave 4</b>                    | Room 1 |
| <b>82. RENEWABLE ENERGY XVII: Wave 5</b>                   | Room 1 |
| <b>92. RENEWABLE ENERGY XVIII: Wave 6: Resources</b>       | Room 1 |
| <b>102. RENEWABLE ENERGY XIX: Tidal &amp; Current 1</b>    | Room 1 |
| <b>112. RENEWABLE ENERGY XX: Tidal &amp; Current 2</b>     | Room 1 |
| <b>122. RENEWABLE ENERGY XXI: Tidal &amp; Current 3</b>    | Room 1 |
| <b>132. RENEWABLE ENERGY XXII: Thermal Energy</b>          | Room 1 |
| <b>142. RENEWABLE ENERGY XXIII: Marine Bioenergy</b>       | Room 1 |

**7. ENVIRONMENT I: Oil Spill and Emission** Room 6



|   |        |
|---|--------|
| 17. ENVIRONMENT II: Physical & Chemical Processes | Room 6 |
| 27. ENVIRONMENT III: Water & Sediment Qualities   | Room 6 |

#### OFFSHORE MECHANICS AND HYDRODYNAMICS (V. 1)

|   |        |
|---|--------|
| 40. OFFSHORE MECHANICS I: Floating Dynamics 1     | Room 9 |
| 50. OFFSHORE MECHANICS II: Floating Dynamics 2    | Room 9 |
| 60. OFFSHORE MECHANICS III: Systems I             | Room 9 |
| 70. OFFSHORE MECHANICS IV: Systems II             | Room 9 |
| 100. OFFSHORE MECHANICS V: Deepwater Installation | Room 9 |
| 110. OFFSHORE MECHANICS VI: Design & Installation | Room 9 |
| 120. OFFSHORE MECHANICS VII: Moored Structures    | Room 9 |
| 130. OFFSHORE MECHANICS VIII: FSRU 1              | Room 9 |
| 140. OFFSHORE MECHANICS IX: FSRU 2                | Room 9 |
| 150. OFFSHORE MECHANICS X: LNG Transport          | Room 9 |

#### GEOTECHNICAL ENGINEERING (V. 2)

|   |        |
|---|--------|
| 59. GEOTECH I: Suction Piles              | Room 8 |
| 69. GEOTECH II: Offshore Foundations      | Room 8 |
| 79. GEOTECH III: Soil Improvement         | Room 8 |
| 89. GEOTECH IV: Cyclic Loading            | Room 8 |
| 99. GEOTECH V: Slope Stability            | Room 8 |
| 109. GEOTECH VI: Piles & Foundations      | Room 8 |
| 119. GEOTECH VII: Consolidation & Seepage | Room 8 |
| 129. GEOTECH VIII: Material Testing       | Room 8 |
| 139. GEOTECH IX: Soil Properties          | Room 8 |
| 149. GEOTECH X: Construction & Materials  | Room 8 |

#### SUBSEA, PIPELINES AND RISERS (V. 2)

|   |        |
|---|--------|
| PLENARY: PNG PIPELINE                                     | Room 7 |
| 48. SUBSEA, PIPELINES, RISERS I: NORD Stream              | Room 7 |
| 58. SUBSEA, PIPELINES, RISERS II: New Concept Development | Room 7 |
| 68. SUBSEA, PIPELINES, RISERS III: Panel                  | Room 7 |
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