Arctic Potential
Realizing the Promise of U.S. Arctic Oil and Gas Resources

April 7-9, 2015
# National Petroleum Council (NPC)

<table>
<thead>
<tr>
<th><strong>Origins</strong></th>
<th>Continuation of WWII government / industry cooperation</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Purpose</strong></td>
<td>Sole purpose of NPC is to advise U.S. Secretary of Energy and Executive Branch by conducting studies at their request</td>
</tr>
<tr>
<td><strong>Organization</strong></td>
<td>A Federally chartered, self-funded Advisory Committee; not an advocacy group, does not lobby</td>
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<tr>
<td><strong>Membership</strong></td>
<td>Broad and balanced. Approximately 200 members from all segments of the oil and gas industries and many outside interests</td>
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<tr>
<td><strong>Study Participants</strong></td>
<td>Diverse interests and expertise relating to the topic being addressed</td>
</tr>
<tr>
<td><strong>Study Reports</strong></td>
<td>All NPC advice is provided in reports approved by its members and is available to the public. Reports can be viewed and downloaded at no cost from the NPC website – <a href="http://www.npc.org">www.npc.org</a></td>
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</table>
In October 2013, the Secretary of Energy requested the NPC to conduct a study

- “What research should the Department of Energy pursue and what technology constraints must be addressed to ensure prudent development of Arctic oil and gas resources while advancing U.S. energy and economic security and ensuring environmental stewardship?”
- The Secretary also noted that the Council’s perspective would be helpful input to the U.S. chairmanship of the Arctic Council, the Quadrennial Energy Review, and implementing the U.S. National Strategy for the Arctic Region

Context

- Today, there is both increasing interest in the Arctic for economic opportunity, and concern about the culture of the Arctic peoples and the changing environment
- Other countries are moving forward with economic development, in this time of change
- The U.S. has large offshore Arctic oil potential, and the technology exists to safely explore for and develop this potential, while maintaining environmental stewardship
- Development would enhance national, economic, and energy security
- Despite this, there are diverse views on moving forward with Arctic development
- In this context, an integrated work plan and a diverse, experienced study team was needed
Study Scope and Outline

**Prudent Development Scope**
- Provide broad context on prudent development
- Global and U.S. perspective
- Onshore and offshore included

**Research and Technology Scope**
- Emphasis given to conventional offshore technology
- Assessed research and technology addressing
  - Current state of technology / research
  - Ongoing research / collaboration
  - Observations / opportunities
  - Recommendations / priorities for U.S. government

**Part 1 – Prudent Development**
- Arctic Resource Potential and History of Operations
- Development Potential and Challenges
- Implementation of U.S. Strategy for the Arctic Region
- Policy and Regulatory Opportunities to Promote Prudent Development

**Part 2 – Technology and Operations**
- Characterization and Measurement of the Ice Environment
- Offshore Arctic Exploration and Development Technology
- Logistics and Infrastructure
- Arctic Offshore Oil Spill Prevention, Control, and Response

**Part 3 – The Environment**
- The Ecological Environment
- The Human Environment
Study Organization

NPC Arctic Research Study

emphasis on research and technology that supports Arctic conventional offshore resource development
Study Organization

emphasis on research and technology that supports Arctic conventional offshore resource development
Study Teams

Study Committee, with members from 30 organizations
• 30 team members: 18 industry, 9 non-industry, 3 government

Coordinating Subcommittee, with participants from 20 organizations
• 23 team members: 7 industry, 9 non-industry, 4 government

Prudent Development led by Chevron
• 47 team members from 20 organizations

Technology and Operations led by ExxonMobil
• 110 team members from 53 organizations

Ecology & Human Environment led by Shell
• 21 team members from 13 organizations

Federal & Alaska Technology Workshops
• 111 participants form industry, government, native, academic, and NGO organizations
External Engagements

Two technology workshops held with government, academia, and Alaskan natives

- Objectives were to brief workshop participants on the study, explore external R&D capability, and identify potential R&D and collaboration opportunities
- Federal workshop held September 23 at Resources for the Future, Washington
  - 54 participants, including 32 from government research organizations
  - Reinforced need for collaborative studies and research, where industry views technology as proven, but regulatory and stakeholder acceptance requires additional information, analysis, and demonstration
- Alaska workshop held November 11 at University of Alaska, Fairbanks
  - 57 participants, including 42 Alaska-based academic, government, and native representatives
  - Validated technology priorities identified in the Washington Workshop

Outreach and input from other interested parties in 21 sessions
Key Findings

1. Arctic Oil and Gas Resources are Large and Can Contribute Significantly to Meeting Future U.S. and Global Energy Needs

2. The Arctic Environment Poses Some Different Challenges Relative to Other Oil and Gas Production Areas, But is Generally Well Understood

3. The Oil and Gas Industry Has a Long History of Successful Operations in Arctic Conditions Enabled by Continuing Technology and Operational Advances

4. Most of the U.S. Arctic Offshore Conventional Oil and Gas Potential Can Be Developed Using Existing Field-Proven Technology

5. The Economic Viability of U.S. Arctic Development is Challenged by Operating Conditions and the Need for Updated Regulations that Reflect Arctic Conditions

6. Realizing the Promise of Arctic Oil and Gas Requires Securing Public Confidence

7. There Have Been Substantial Recent Technology and Regulatory Advancements to Reduce the Potential for and Consequences of a Spill
Large Arctic Oil and Gas Potential

Arctic Oil and Gas Resources are Large and Can Contribute Significantly to Meeting Future U.S. and Global Energy Needs

• The global Arctic contains about 25% of remaining undiscovered global conventional resources (USGS), and the U.S. has a large portion of oil potential

• If exploration starts now, offshore Alaskan development could coincide with the expected decline in the lower 48 fields

• National security and economic benefits associated with increased U.S. activity
The Arctic Environment

The Arctic Environment Poses Some Different Challenges Relative to Other Oil and Gas Production Areas, but is Generally Well Understood

- The Arctic has been studied for many years by industry, government, and academia, and much is known about the physical, biological, and human environment
- Key characteristic distinguishing the Arctic is ice: ice type, water depth, open water season
- Experiences from other remote and challenging oil and gas areas applicable
- The climate is changing and there are additional information / monitoring opportunities, such as interaction of key species with oil and gas activities

First-year ice with numerous pressure ridges

Multi-year ice ridge in the Canadian Beaufort Sea

Iceberg, ~ 200 meters across, in open water
Long History, Enabled by Technology Advances

The Oil and Gas Industry Has a Long History of Successful Operations in Arctic Conditions Enabled by Continuing Technology and Operational Advances

NPC Arctic Research Study
Most of U.S. Arctic Offshore Conventional Oil and Gas Resources Can Be Developed Using Existing Field-Proven Technology

### Physical Ice Environment and Water Depth

<table>
<thead>
<tr>
<th>Description</th>
<th>Examples</th>
<th>Technology to Explore &amp; Develop</th>
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</thead>
<tbody>
<tr>
<td>Typically ice free, any water depth</td>
<td>- South Barents Sea</td>
<td>Exploration &amp; development proven (Various drilling rigs, floating solutions, GBS, subsea tieback)</td>
</tr>
<tr>
<td></td>
<td>- Newfoundland</td>
<td></td>
</tr>
<tr>
<td>Any ice conditions, near shore &amp; shallow water</td>
<td>- Globally, near shore (including US Beaufort and Chukchi Seas)</td>
<td>Exploration &amp; development proven (Ice &amp; gravel islands, concrete &amp; steel structures, extended reach drilling from onshore)</td>
</tr>
<tr>
<td>- ~&lt;15m water</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Open water &gt; ~2 months, any water depth</td>
<td>- Sea of Okhotsk</td>
<td>Exploration proven; development proven mainly in ~&lt;100m water</td>
</tr>
<tr>
<td>- Mainly first year ice, potential for combination of multi-year ice, icebergs and ice islands</td>
<td>- Pechora Sea</td>
<td>Ice management required ~&lt;100m development by GBS</td>
</tr>
<tr>
<td>- Water depth determines development concept (greater or less than ~100m is key)</td>
<td>- Labrador Sea</td>
<td>~&lt;100m development by floating drilling &amp; subsea tieback</td>
</tr>
<tr>
<td></td>
<td>- US Chukchi &amp; Beaufort Seas</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- South Kara Sea</td>
<td></td>
</tr>
<tr>
<td>Open water &lt;~2 months, any water depth</td>
<td>- Deepwater Beaufort Sea</td>
<td>Exploration &amp; development possible with technology improvements</td>
</tr>
<tr>
<td>- Likely to encounter multi-year ice and/or icebergs, and in some locations ice islands</td>
<td>- Deepwater Northern Russian Arctic Seas</td>
<td>Increased ice management capability and possible new technology</td>
</tr>
<tr>
<td>- Water depth determines development concept, (greater or less than ~100m is key)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Limited to no open water</td>
<td>- North East Greenland</td>
<td>Technology extensions or new technology required</td>
</tr>
<tr>
<td>- Frequent multi-year ice with embedded icebergs, and ice islands</td>
<td>- Deepwater Northern Russian Arctic Seas</td>
<td>Floating, robust ice managed solutions</td>
</tr>
<tr>
<td></td>
<td></td>
<td>GBS / Subsea technology extensions or new technologies</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Difficult to mobilize equipment without open water season</td>
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</tbody>
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### Increasing Complexity to Explore & Develop
The Economic Viability of Alaskan Arctic Development is Challenged by Operating Conditions and the Need for Regulations that Reflect Arctic Conditions

- Technical feasibility is not the only consideration
- Arctic exploration and development is more costly than in other areas due to remoteness, challenging climate, short operating seasons, and infrastructure
- Stakeholder alignment and regulatory efficiency also influence economic viability
- Resource opportunities of sufficient size and quality must be found
- Two areas are currently limiting exploration
Securing Public Confidence Required

Realizing the Promise of Arctic Oil and Gas Resources Requires Securing Public Confidence

**Industry and government** have a shared responsibility to gain and maintain the public trust

- Both must engage the local community

**Industry** must operate responsibly and continuously improve technology and operations

- Commitment to operate safely and with high environmental standards
- Maintain and continuously improve risk management systems, practices, tools

**Government** must maintain / continuously improve policies and regulations that ensure public safety and environmental protection, and support development

- Long history of Arctic policy and regulations
- Coordination / role clarity essential
- 39 agencies in the Arctic Policy Group
- 27 agencies / groups in the Implementation Plan for the National Arctic Strategy
- 22 members of the Arctic Executive Steering Committee
There Have Been Substantial Recent Technology and Regulatory Advancements to Reduce the Risk and Consequences of a Spill

- The greatest reduction of environmental risk comes from preventing a spill
- Recently developed control and mitigation technologies should be assessed
Recommendations

Although the technology exists today to explore and develop the majority of U.S. offshore oil and gas potential, additional research opportunities are recommended to:

• Validate recently developed technology for use in the U.S. offshore
• Pursue technology extensions that could lead to improved safety, environmental, or cost performance

Policy and regulatory recommendations are included where they enable the application of best technology and practices

Total 32 recommendations (13 research, 3 regulatory, 16 leadership/policy), in the Executive Summary

• Additional 60 research recommendations in the report

Recommendations grouped into themes: Environmental Stewardship; Economic Viability; Government Leadership and Policy Coordination
Environmental Stewardship

The NPC recommends:
• Industry and regulators should work together to perform the analysis, investigations and any necessary demonstrations to validate technologies for improved well control
• Government agencies should participate in ongoing and future industry collaborative research programs for oil spill response in ice, such as the Arctic Response Technology Joint Industry Programme that has been underway since 2012
• Regulators should continue to evaluate oil spill response technologies in Arctic conditions, and all spill response technologies should be pre-approved to enable selection of the appropriate response technology to achieve the greatest reduction in environmental impacts
Environmental Stewardship, continued

The NPC recommends:

• Long term population estimates and understanding of the interactions of key species with oil and gas activities should be enhanced, to improve efficiency of exploration and environmental stewardship

• Collaboration and coordination of ecological and human environment research should be improved

• An updated Socioeconomic Impact Assessment protocol is needed
Economic Viability

Considering economic viability, the NPC recommends:

• Industry, government, and regulators should perform the analysis, investigations and necessary demonstrations to validate technologies / capabilities to safely extend the drilling season

• The Department of Energy and the Department of the Interior should assess the timelines to progress an offshore exploration and development program, compared with current U.S. lease durations and practices in other jurisdictions

• Policies, regulations, and implementation practice should encourage innovation and enable use of technology advances
Government Leadership and Policy Coordination

Considering domestic leadership and policy coordination, the NPC recommends:

• The Arctic Executive Steering Committee should reaffirm U.S. commitment to prudent Arctic oil and gas development, assess alignment across federal agencies, and clarify the process by which it will collaborate with Alaskans

• The Arctic Executive Steering Committee as part of its mandated gap analysis should request regulators to compile a comprehensive and integrated inventory of regulatory requirements, and assess the interagency working group for lessons learned and improvement opportunities

• The Department of Energy should designate a senior advisor to support DOE’s representative on the Arctic Executive Steering Committee and be a focal point for Arctic policy

Considering the Arctic Council, the NPC recommends:

• As Arctic Council members implement the two international agreements on search and rescue (2011) and on oil pollution preparedness and response (2013), the U.S. government should engage with the energy industry on response exercises

• The U.S. government should strengthen the Arctic Economic Council’s interaction and engagement with the Arctic Council
Forward Plans

Digital Publications and Communications
- Approved by the Council March 27, 2015
- Report available for download
  - Video – 5 minutes
  - Executive Summary
  - Full Report
  - Topic Papers
  - Council Webcast

Printed Report Publication
- Executive Summary volume available mid April
- Full report available end May
- eBook available early June

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Communications

Communications Events

• Alaska briefings, April 7-9
• Arctic Panel Discussion hosted by CSIS, April 17
• Other Washington and Alaska Communications, during April
• Energy Council, June 18-20

Protocol for Ongoing Communications

• Any individual or organization may use the NPC Arctic Research report in expressing their own views, provided that it is properly cited
• If the request did not originate from the NPC, please inform the NPC staff, and provide the name of the presenter, the audience, and a copy of the presentation or report
• Presenters are to be mindful of the purpose of the Council, and the prohibition against lobbying
March 27, 2015 Meeting of the NPC:
The 125th meeting of the National Petroleum Council was held in Washington, D.C., on Friday, March 27, 2015.

- Meeting press release (.pdf)
- Arctic Potential: Realizing the Promise of U.S. Arctic Oil and Gas Resources Report materials
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Global Arctic Conventional Endowment

Global Arctic Conventional Oil and Gas Resource Potential by Country

1 Natural gas liquids not shown
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**Drilling Season Length**

<table>
<thead>
<tr>
<th>Drilling Start (July 7)</th>
<th>Drilling End (Sept 24)</th>
<th>Freeze-Up (Nov 1)</th>
</tr>
</thead>
<tbody>
<tr>
<td>July</td>
<td>August</td>
<td>October</td>
</tr>
</tbody>
</table>

Drilling Time Available
- 79 days

- Relief Well 38 days

Drilling Time Available
- 147 - 161 days

**Lease Length**

<table>
<thead>
<tr>
<th>Country</th>
<th>License / Lease System</th>
<th>Typical Well Count to Retain License / Lease</th>
<th>License / Lease Duration</th>
</tr>
</thead>
<tbody>
<tr>
<td>Canada</td>
<td>Exploration Based</td>
<td>1 - 2</td>
<td>9 years</td>
</tr>
<tr>
<td>Greenland</td>
<td>Exploration Based</td>
<td>1 - 2</td>
<td>Up to 16 years</td>
</tr>
<tr>
<td>Norway</td>
<td>Exploration Based</td>
<td>1 - 2</td>
<td>Up to 30 years</td>
</tr>
<tr>
<td>Russia</td>
<td>Exploration Based</td>
<td>1 - 2</td>
<td>10 years</td>
</tr>
<tr>
<td>USA</td>
<td>Development Based</td>
<td>6 - 7</td>
<td>10 years</td>
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