CANADA-NEWFOUNDLAND & LABRADOR
C-NLOPB
OFFSHORE PETROLEUM BOARD

Turning 50…
The Regulators' Perspective on Untapped Resources

Jeff O'Keefe
Director of Resource Management
and Chief Conservation Officer

Safety Moment

Safety First

And

Always Take An Alarm Seriously

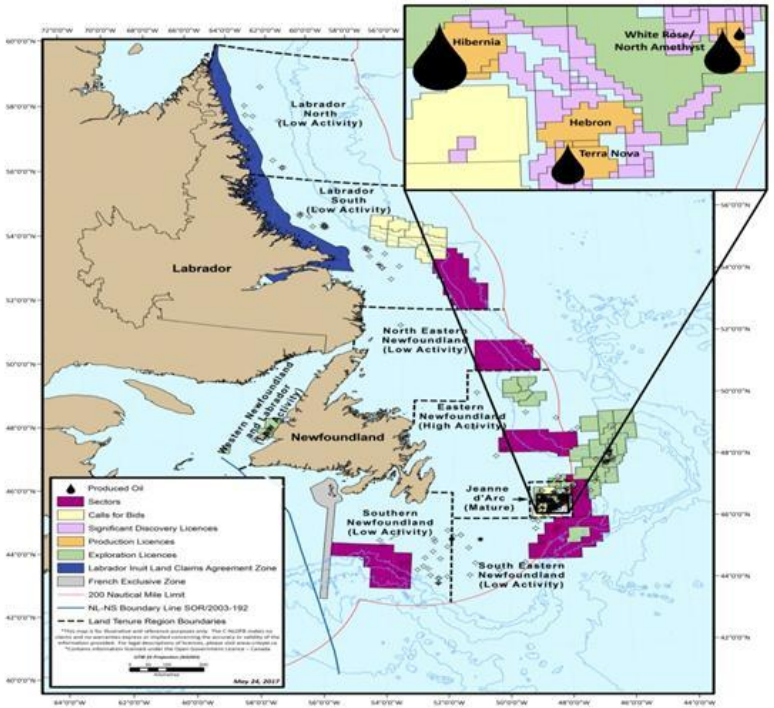
Canada-Newfoundland and Labrador Offshore Area

Current Statistics:

- 441 wells spud since 1966, including 169 exploration wells
- 1.6 billion barrels of oil produced from 4 projects
- Hebron is expected to have first oil later this fall
- The equivalent of approximately 3.8 million line km of seismic data

Current Licences/Land Tenure Items:

- 29 Exploration Licences (ELs)
- 55 Significant Discovery Licences (SDLs)
- 12 Production Licences (PLs)
- 5 Sectors
- 13 Call for Bids Parcels



Drillship *Glomar Sirte* 1966 (50 years ago)

#1 Tors Cove D-52 (South Whale Basin)

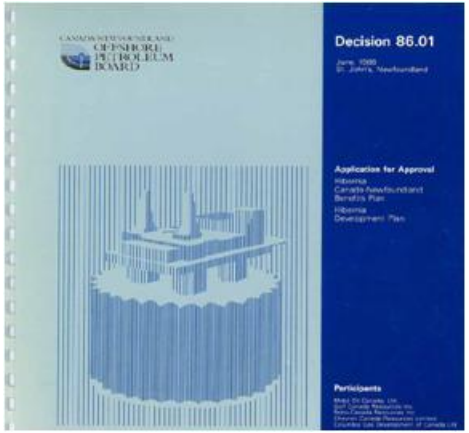
Spud: *1966-06-07*

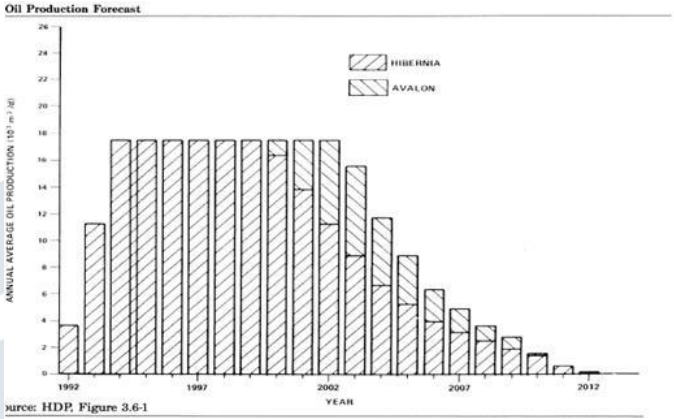
picasa.jpg

Transocean Barents Drilling Rig, 2017

Photo Transocean

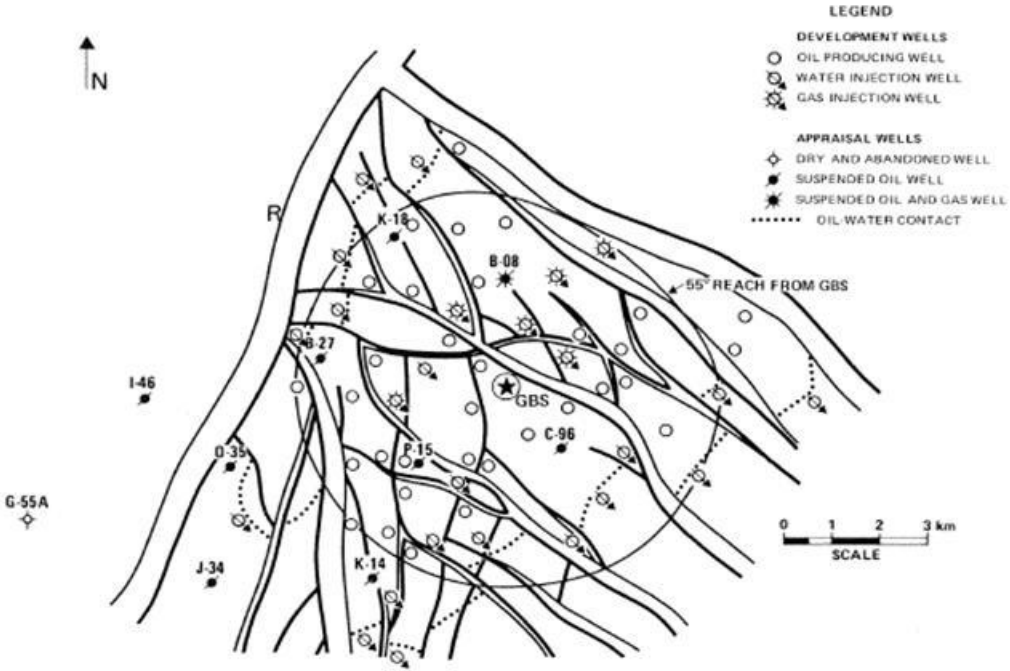
Hibernia Original Decision 1986





urce: HDP, Figure 3.6-1

Figure 3-14
Proposed Development Well Layout
Hibernia Sandstones



Source: HDP, Figure 3.4-1

Source: CNLOPB Decision 86.01

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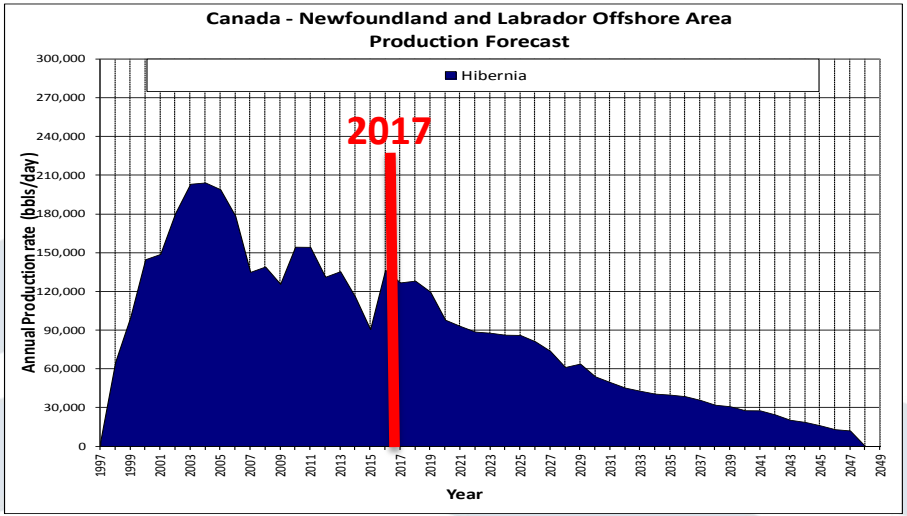
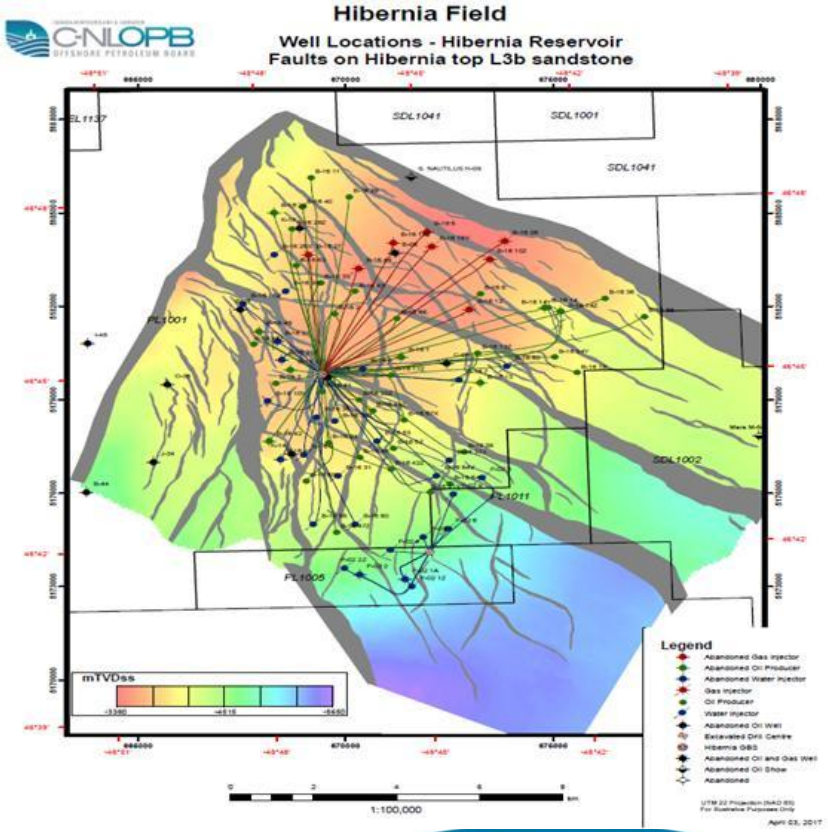
Hibernia 2017

- over 1 Billion bbls produced (600 million to go)
- 120 wells drilled
- Estimated field of life 2047

- Gas lift started last year
- Preliminary production from the Catalina formation
- WAG EOR pilot began in February
- Infill opportunities being planned
- Ben Nevis Avalon exploitation plan being reviewed





Terra Nova Original Decision 1997

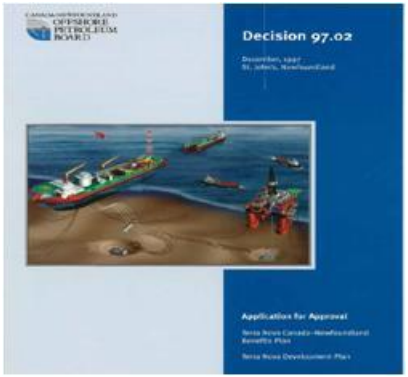
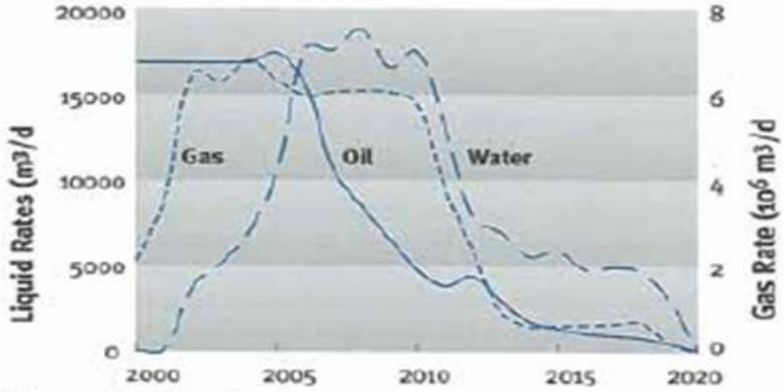
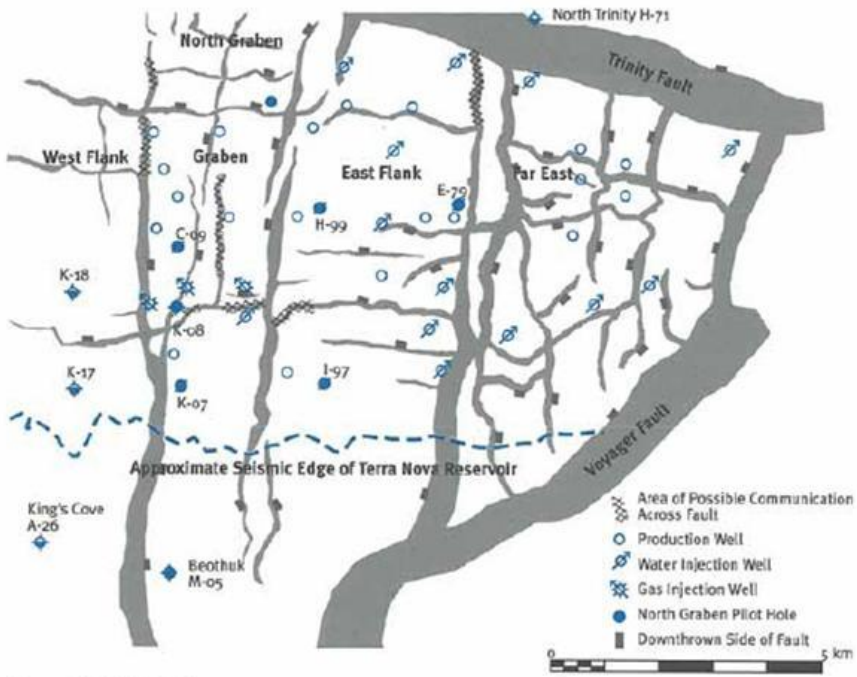


FIGURE 4.5
Reference Case Production Profiles



Source: after Petro-Canada, 1997

FIGURE 4.4 **Proposed Graben, East Flank and Far East Development Well Locations**



Source: after Petro-Canada, 1997

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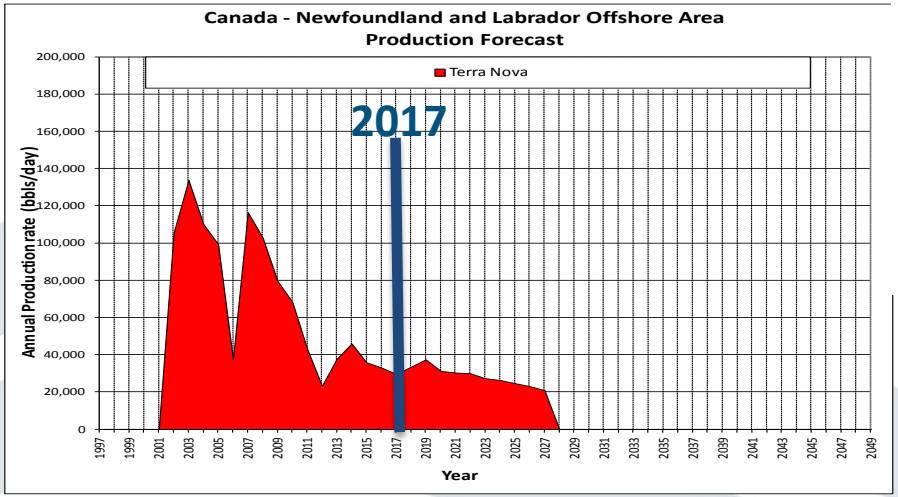
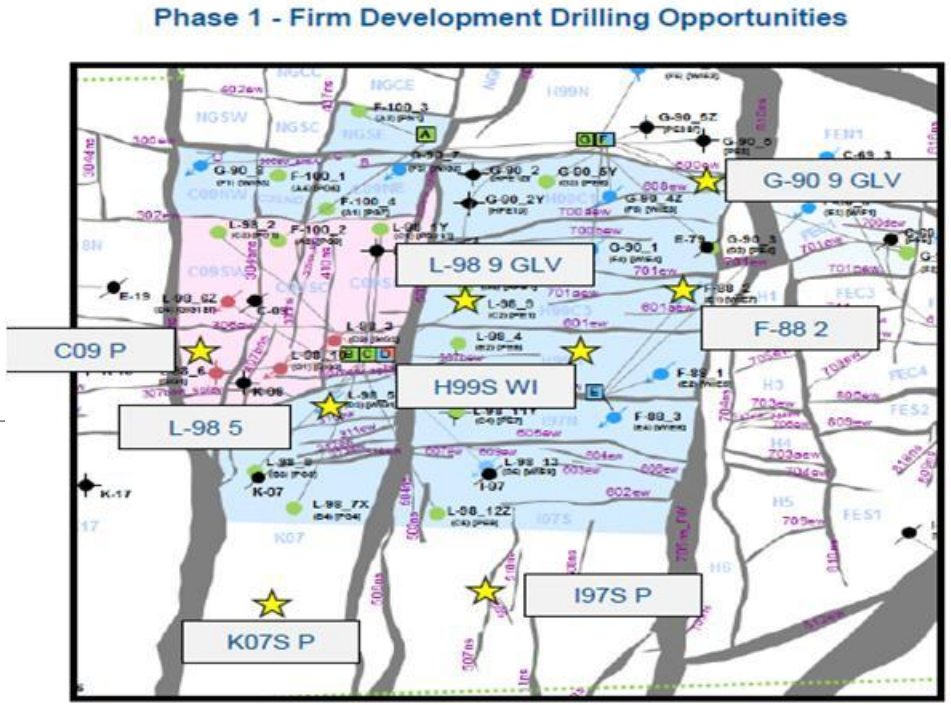
Terra Nova 2017

- 395 million bbls produced (110 million to go)
- 51 wells drilled to date
- Estimated field of life 2027

- Infill wells/ workovers being planned
- Terra Nova Asset life extension being evaluated with turnaround for 2022
- Other projects
  - -Gas to water conversion
  - - possible Far East development





White Rose Original Decision

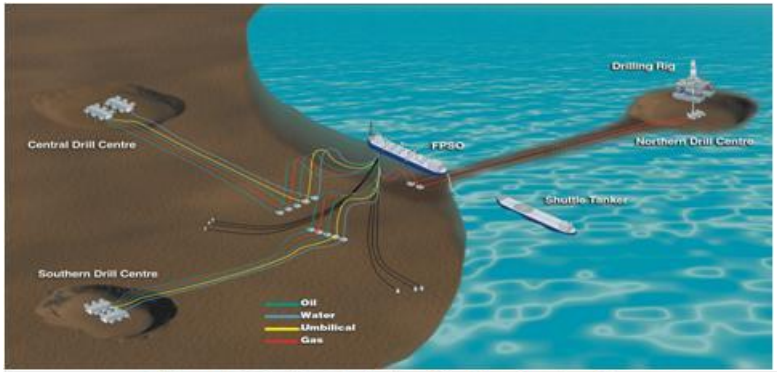
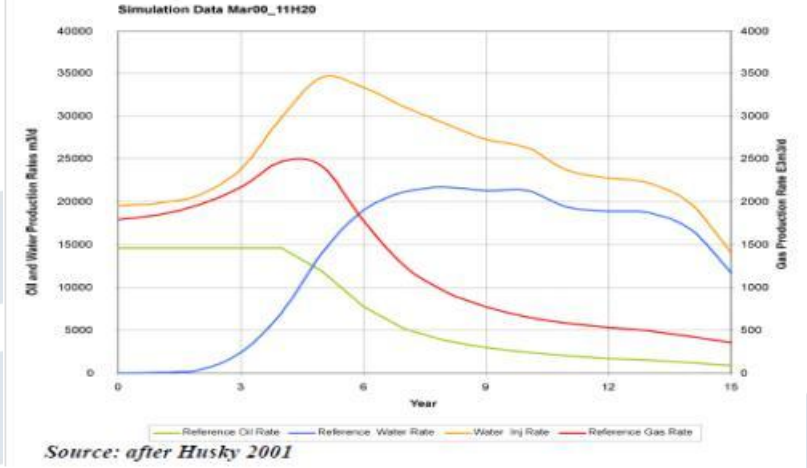
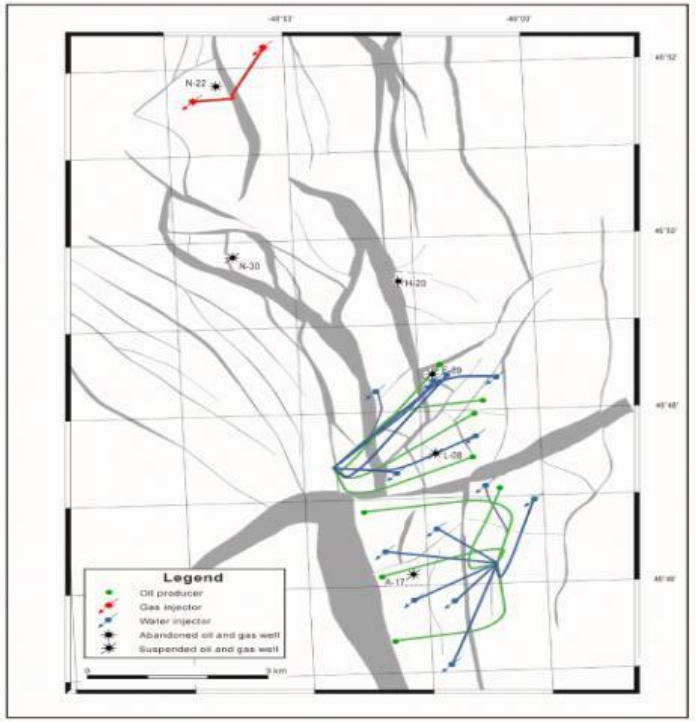


Figure 4.10 South Avalon Pool Production Forecast



Source: after Husky 2001

Figure 4.9 Updated South Avalon Pool Well Layout

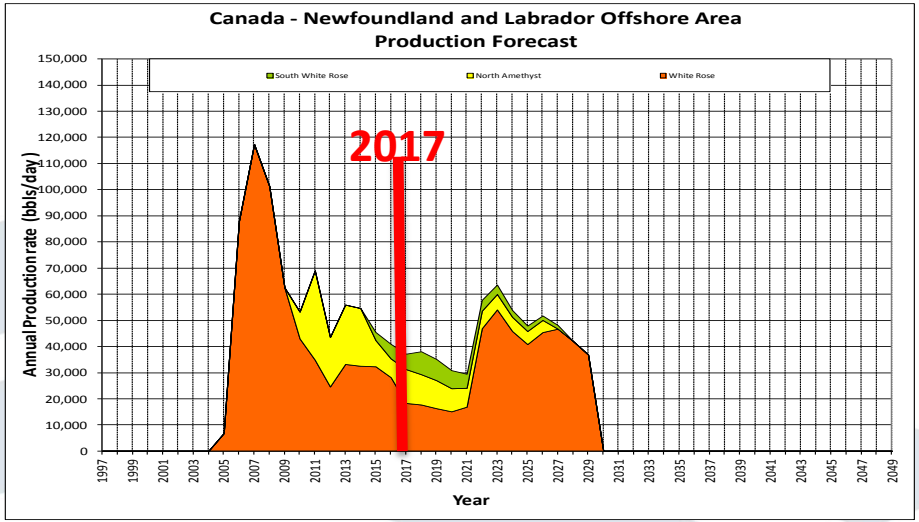


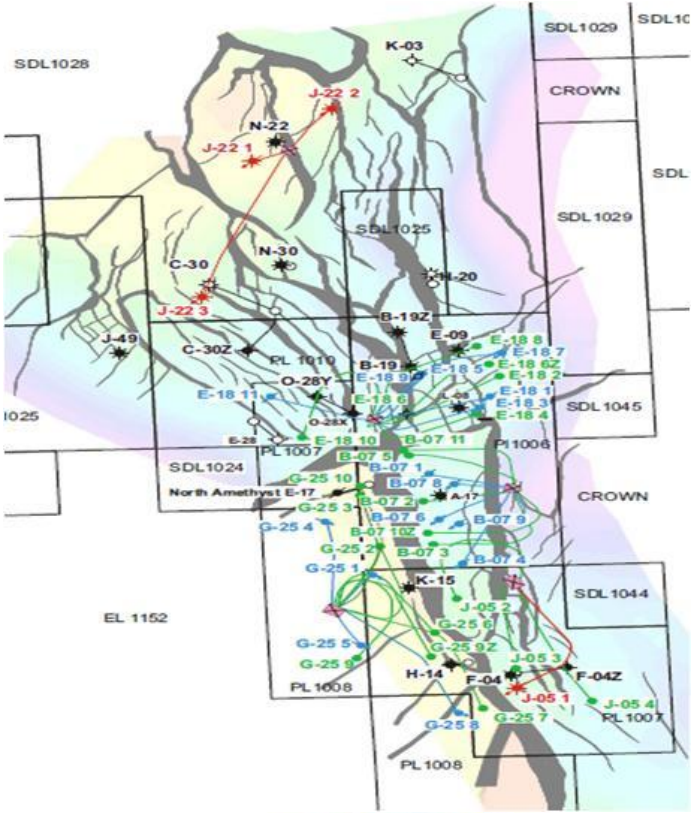
Source: after Husky 2001

White Rose/North Amethyst 2017

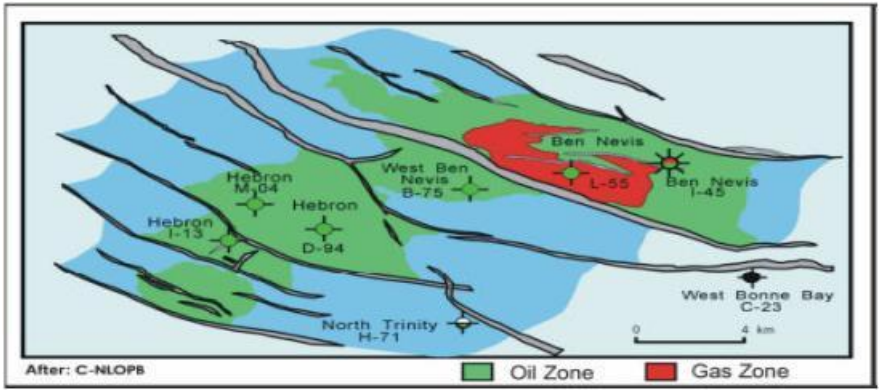
- Over 275 million bbls produced (190 million to go)
- 47 wells drilled
- Estimated field of life 2030

- West White Rose Pool (Wellhead) project been recently sanctioned with first oil in 2022
- Infill opportunities being planned
- Gas flooding being utilized for both White Rose and proposed for North Amethyst fields

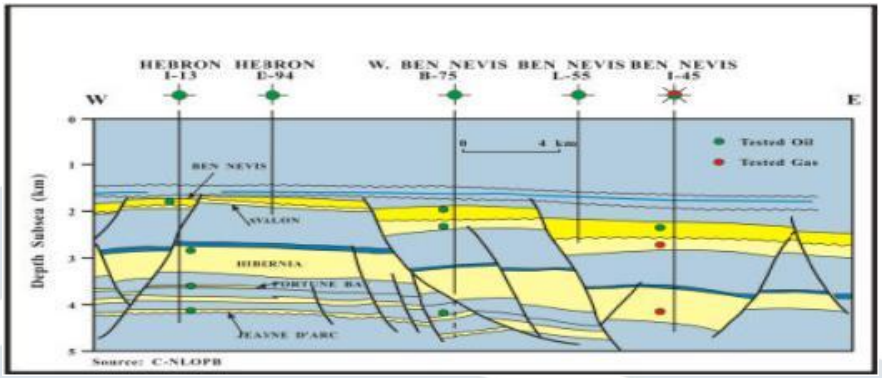




Hebron/Ben Nevis



Hebron/Ben Nevis Field Geological Cross Section



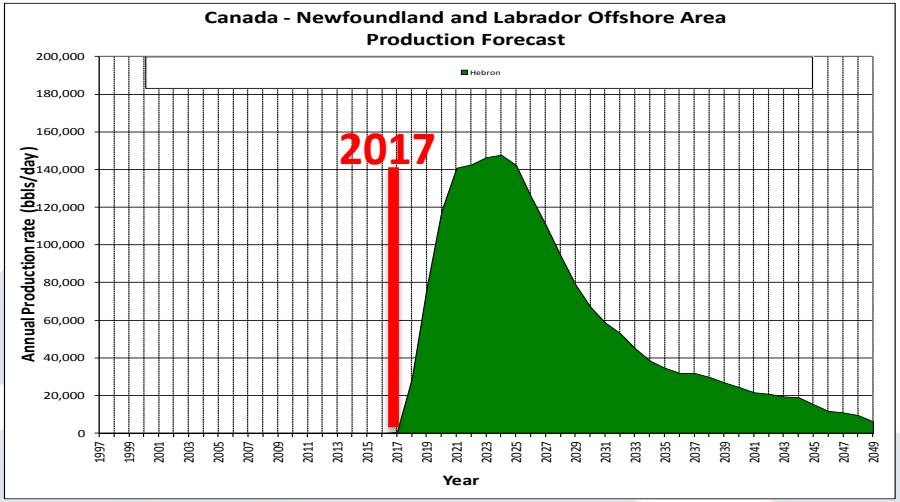
Structure Map of Avalon/Ben Nevis Sandstone. 2005

- Discovered: 1981
- Located in Southern Jeanne d'Arc Basin
- Fields:
  - Hebron
  - West Ben Nevis
  - Ben Nevis
- Key Reservoirs
  - Avalon / Ben Nevis Sandstone
  - Hibernia Sandstone
  - Jeanne d'Arc Sandstone
- Initial Resource Estimate
  - 414 million barrels of oil
  - 315 bcf of natural gas
  - 30 million barrels of natural gas liquids.

Hebron/Ben Nevis 2017

- First oil expected in Q4 2017
- 52 wells slots
- Life of field 2049
- Production rate at 150,000 bbls/d
- Reserves estimated 707 million bbls

New Technology
- Use of gravel pack completion
- Use of Vessel internal electrostatic coalescer



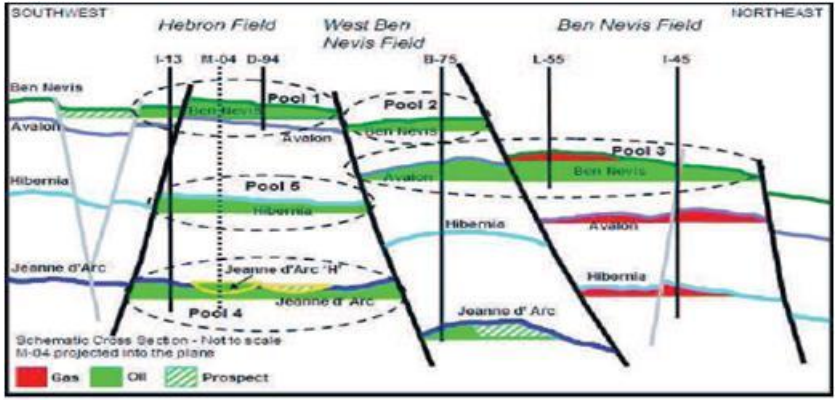


Figure 1.4-1: Schematic Cross-section across the Hebron Project Area

Courtesy ExxonMobil Properties Canada

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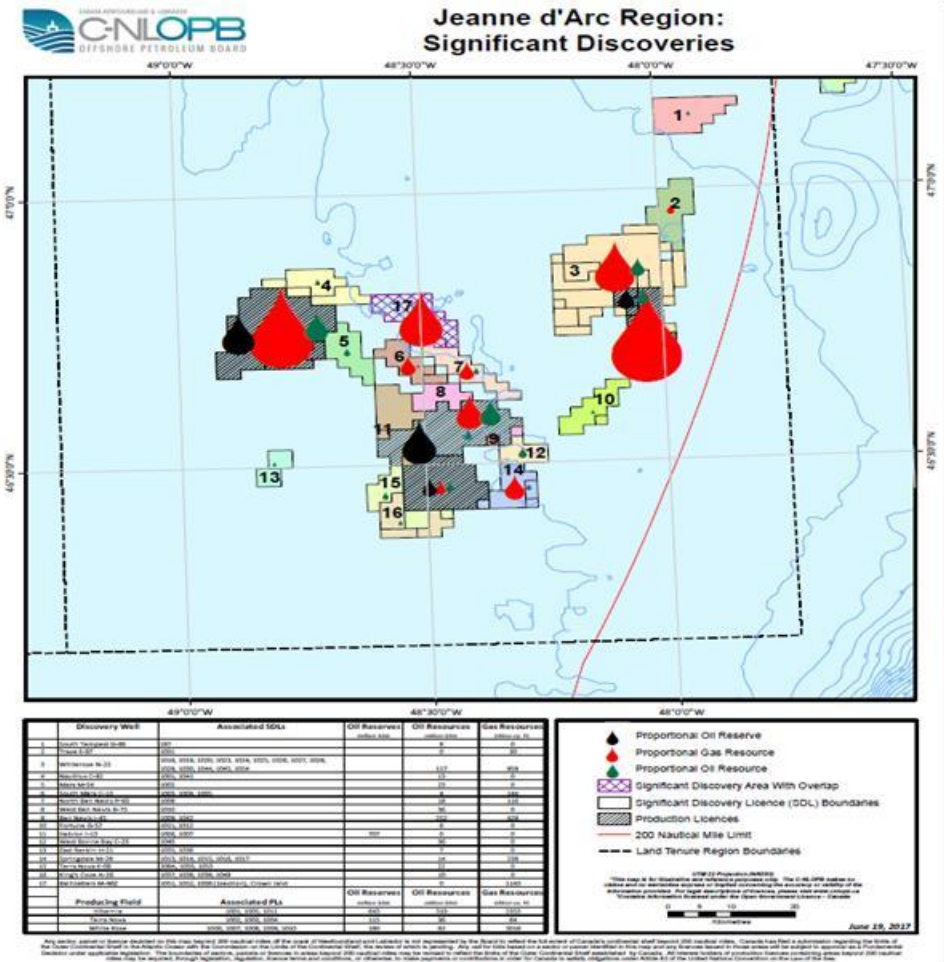
Remaining Reserves/Resources



Discovery Well	Associated SDLs	Oil Reserves	Oil Resources	Gas Resources
1 South Tempest D-90	1997		0	0
2 Hibernia N-22	1979, 1980, 1981, 1982, 1983, 1984, 1985, 1986, 1987, 1988, 1989, 1990, 1991, 1992, 1993, 1994		117	459
3 Hebron I-13	1980, 1981		13	0
4 Mara M-54	1999		13	0
5 North Amethyst G-12	2003, 2004, 2005		0	0
6 North Dana K-90	2004		18	118
7 West Bonne Bay E-72	2000		36	0
8 Ben Nevis L-67	1998, 1999		112	428
9 Trinity B-52	2001, 2002		0	0
10 Hebron I-13	1980, 1981	707	0	0
11 West Bonne Bay C-20	1998		36	0
12 East Ben Nevis H-11	2005, 2006		7	0
13 Jeanne d'Arc M-28	2013, 2014, 2015, 2016, 2017		18	139
14 Terra Nova K-98	1984, 1985, 1986		64	0
15 Wright Creek N-29	1997, 1998, 1999, 2000		20	0
16 Bel Kielbasa M-46C	2011, 2012, 2013 (sanctioned), Crown land		0	1165

Producing Field	Associated PLs	Oil Reserves	Oil Resources	Gas Resources
Hibernia	1979, 1980, 1981	643	310	2353
Terra Nova	1984, 1985, 1986	115	36	64
White Rose	1996, 1997, 1998, 1999, 2000	180	83	3018

Hibernia 643 million bbls oil reserves
310 million bbls oil resources
2353 billion cu ft gas resources

Terra Nova 115 million bbls oil reserves
36 million bbls oil resources
64 billion cu ft gas resources

White Rose 180 million bbls oil reserves
83 million bbls oil resources
3018 billion cu ft gas resources

Hebron 707 million oil reserves
288 million oil resources
429 billion cu ft gas resources

<u>Rest of Jeanne D' Arc basin</u>

139 million oil resources
1671 million cu ft gas resources

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Lessons Learned from the Regulator's Perspective on Potential on Offshore Developments

- **Data is the key**
  Continuous collection and analysis of data (seismic, well, core, production, etc) must be ongoing and must be able to integrate into models and systems to maximize the potential

- **Adapt and always learning**
  Use of new technologies/techniques

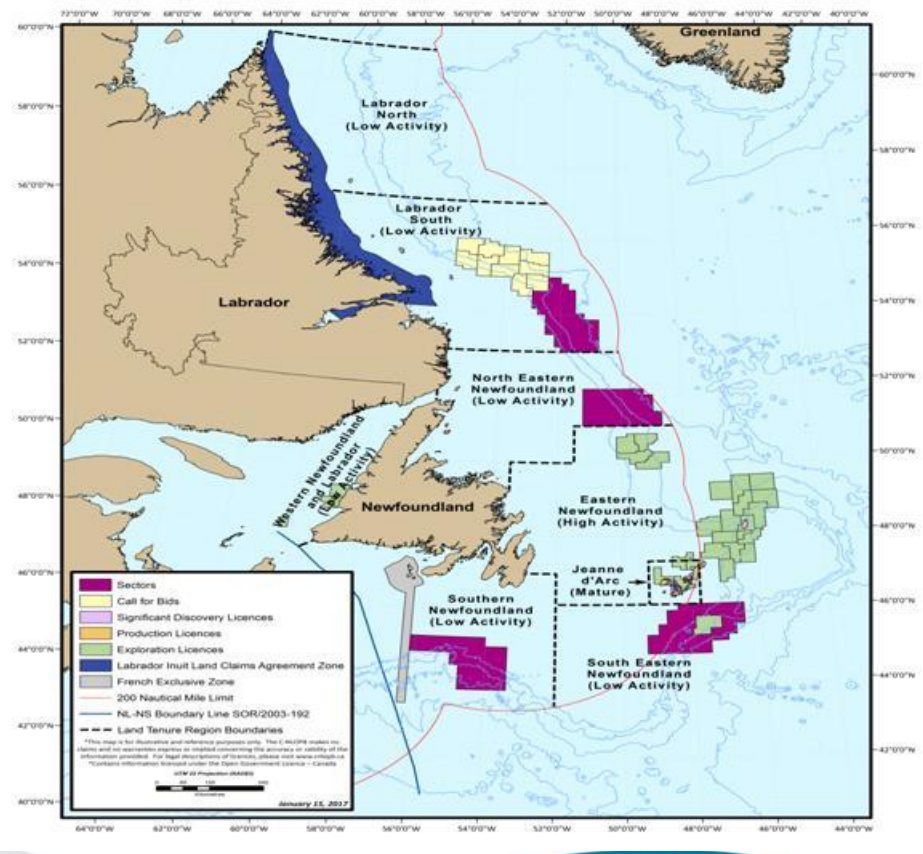
- **Must be willing to look at alternatives**
  "outside the box "

Resource Management Changes to Regulating Potential

1. Scheduled Land Tenure system
2. Use of Production Pilots
3. Use of new technology to achieve the same legislative goals
   Example: FTWT vs. DSTs in Significant Discovery applications

1. Scheduled Land Tenure

- Improves transparency, predictability and user input
- Provides additional time to assess hydrocarbon prospectivity
- Timing of the process is defined by the activity of the Region
- Three licence timing cycles:
  - 4-year for Low activity regions
  - 2-year for High activity regions
  - 1-year for Mature regions



2017 Geoscience Programs with Fieldwork

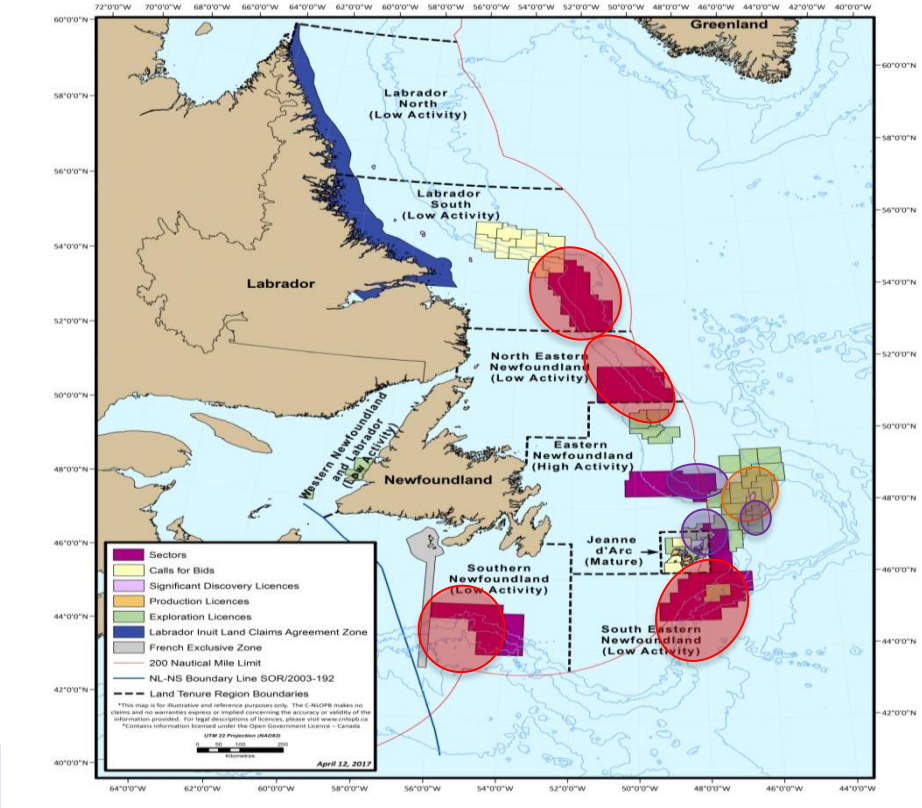
2017 Programs in Progress:

- **2D Seismic** – MKI
  - South Grand Banks (SN and SEN)
    - ~ 13,500 line km
  - Labrador Sea (LS and NEN)
    - ~ 8500 line km
- **3D Seismic** – MKI
  - West Flemish Pass (EN)
    - ~ 9000 km^2
  - Carson Basin (SEN)
    - ~ 3650 km^2

2017 Anticipated Programs:

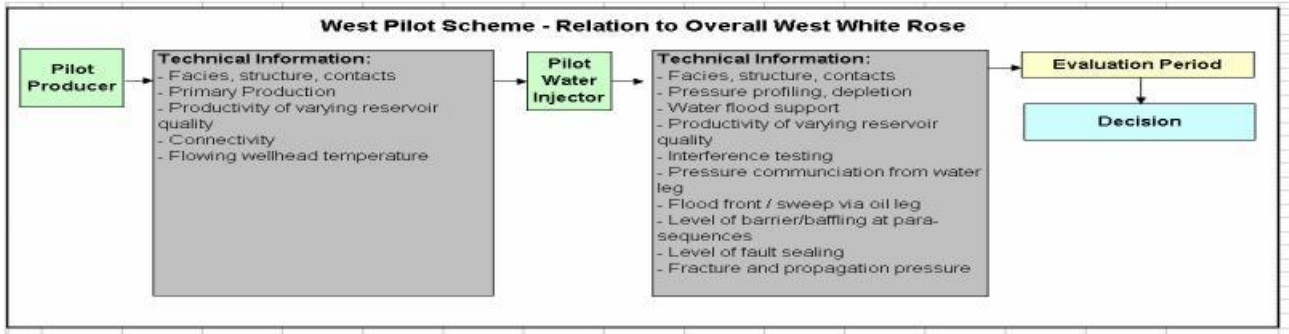
- **Controlled Source Electromagnetics** (EMGS)
  - Flemish Pass (EN)

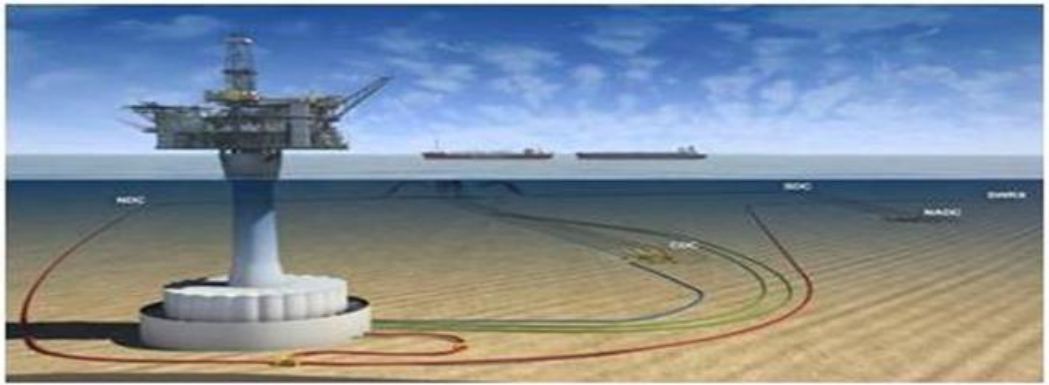
5 of 8 Land Tenure Regions potentially explored



2. Use of Pilots – To maximize the potential

- Use of Pilots projects to gather dynamic production data to better optimize depletion plans and reduce the uncertainty





3. Recent Decision
FTWT vs. DST in SDD Applications

- After a Statoil submission in March 2017, the Board recently acknowledged that Formation Testing While Tripping (FTWT) technology does meet the legislative requirements of the Formation Flow Testing regulations.

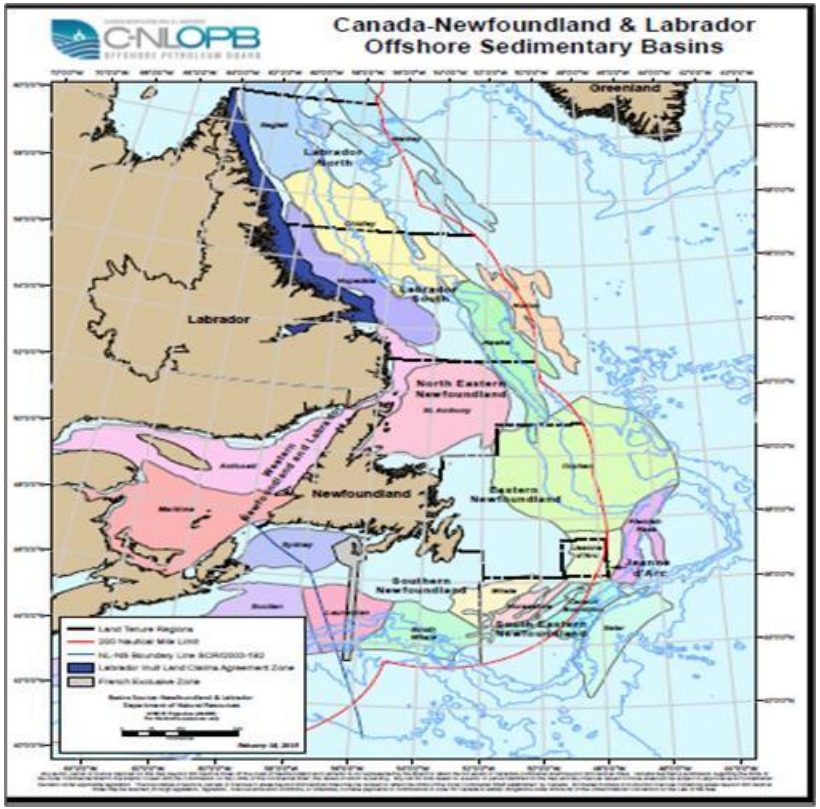
- However, FTWT is **not equivalent** to Drill Stem Test (DST).

- FTWT could be used in requirement for formation flow testing in support of an application for "Significant Discovery Declaration (SDD)".

- In any Significant Discovery Declaration **all criteria** provided by the applicant is considered.

- Guidance is now being written by the C-NLOPB in the use of this application of technology for operators to consider in future SDD.

So what does this mean for the potential for the offshore?



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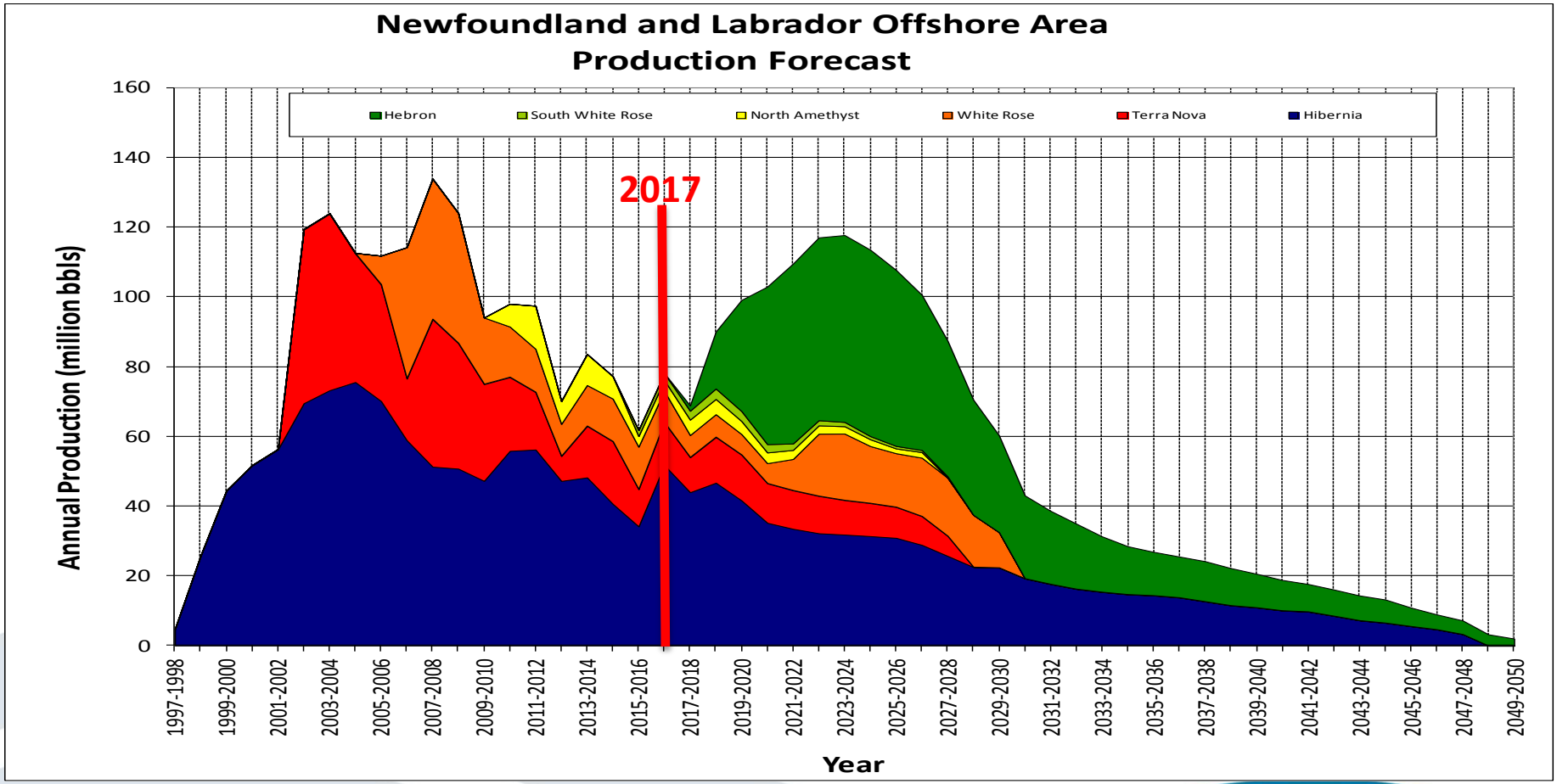
Newfoundland and Labrador Offshore Area
Production Forecast
Hebron
South White Rose
North Amethyst
White Rose
Terra Nova
Hibernia
2017
Annual Production (million bbls)
Year
0
20
40
60
80
100
120
140
160
1997-1998
1999-2000
2001-2002
2003-2004
2005-2006
2007-2008
2009-2010
2011-2012
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2045-2046
2047-2048
2049-2050

Thank You

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