

National Petroleum Council

Prudent Development

Realizing the Potential of North America's Abundant
Natural Gas and Oil Resources

Focus on Tight Oil

CSIS

*Washington DC
December 7, 2011*

NPC Study Objectives

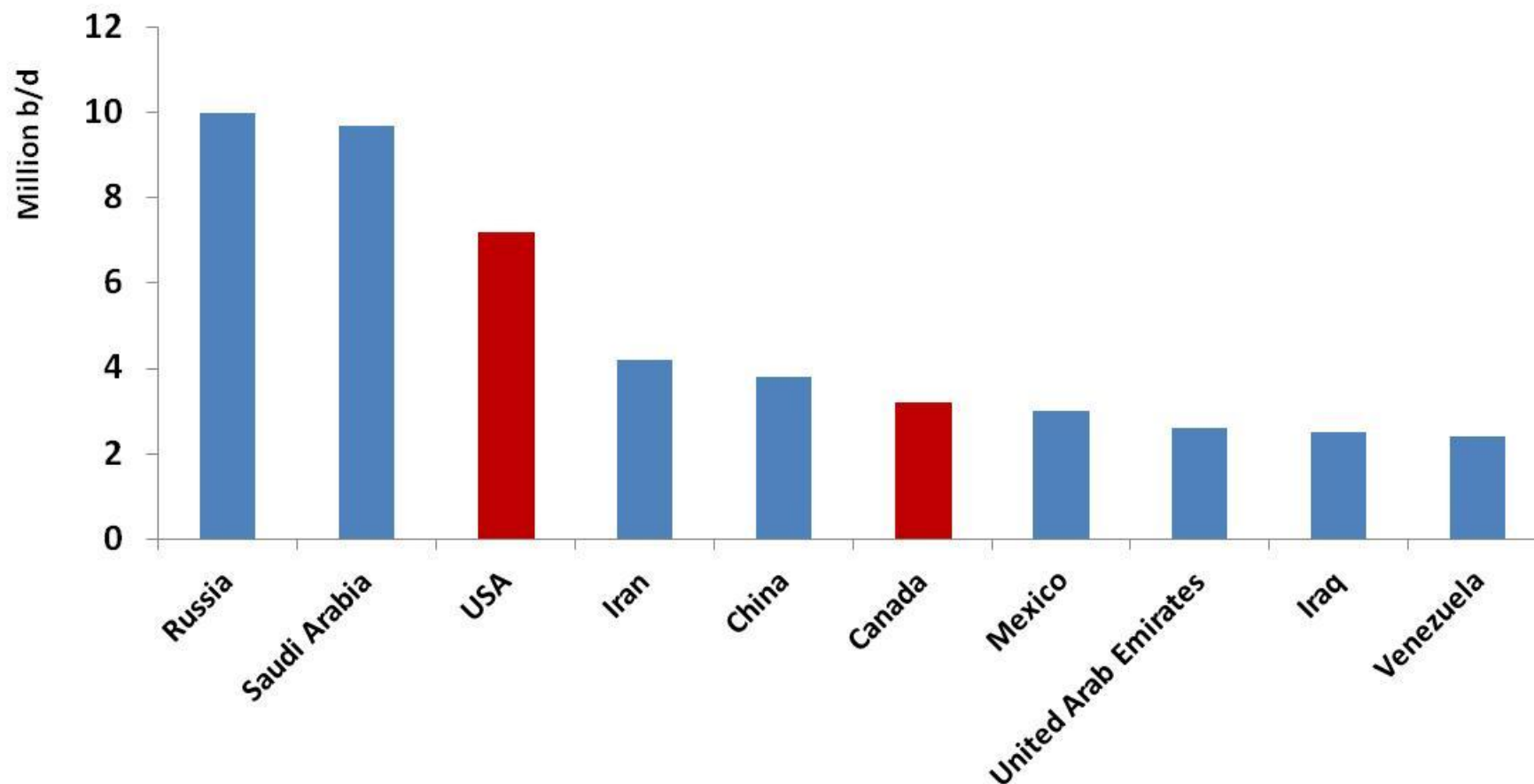
- **Assess the N. American resource base – natural gas and oil**
 - Conventional
 - Unconventional
- **Describe the role of technology**
 - Environmental
 - Operational
- **Assess N. American supply and demand**
 - Through 2035
 - With a view to 2050
- **Identify the potential role of natural gas to lower emissions**
- **Meet national objectives: economic, environmental, security**

Surprisingly, North American Oil Resources are Abundant

- North America has world-class oil resource basins
- Future access depends upon responsible development practices



Top 10 Oil Producers



Source: BP Statistical Review of World Energy

North America Oil Supply Segments

Conventional

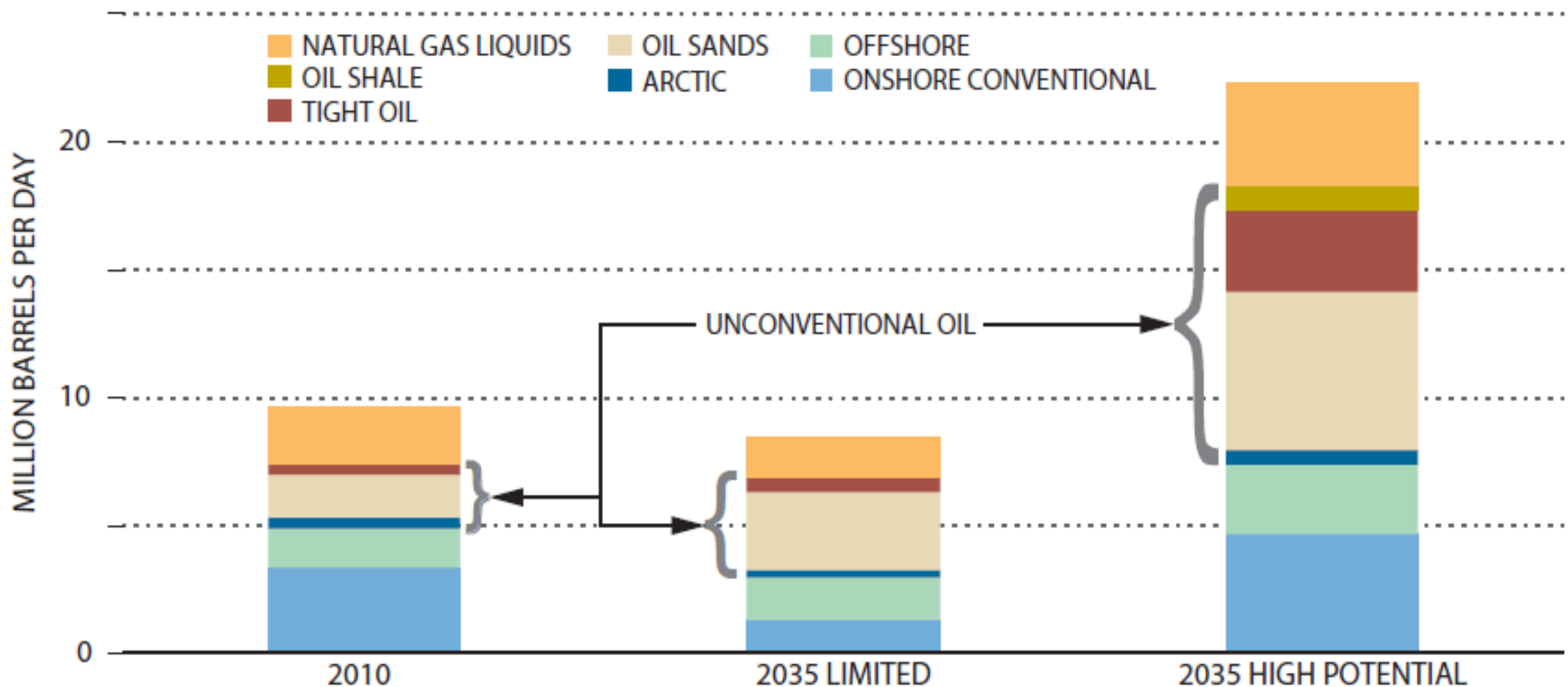
- Onshore conventional and EOR
- Offshore
- Arctic
- Natural Gas Liquids

Unconventional

- Oil sands (Canada)
- Heavy Oil (Canada)
- Oil sands (US)
- Tight Oil
- Oil shale

NA Oil Supply Potential in NPC Study

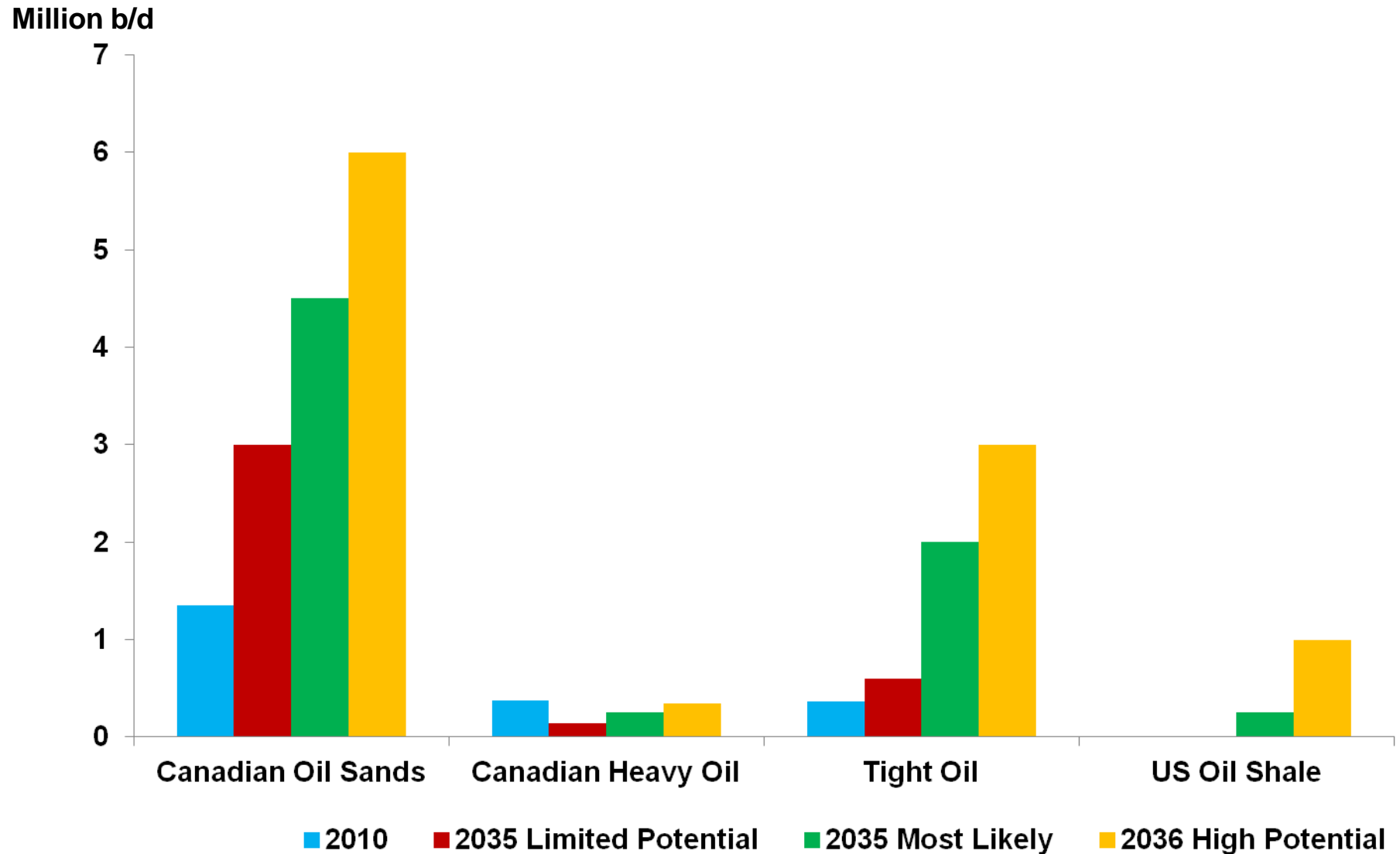
Figure 1-5. More Resource Access and Technology Innovation Could Substantially Increase North American Oil Production



Note: The oil supply bars for 2035 represent the range of potential supply from each of the individual supply sources and types considered in this study. The specific factors that may constrain or enable development and production can be different for each supply type, but include such factors as whether access is enabled, infrastructure is developed, appropriate technology research and development is sustained, an appropriate regulatory framework is in place, and environmental performance is maintained.

Source: Historical data from Energy Information Administration and National Energy Board of Canada.

NA Unconventional Oil Supply Potential in NPC Study

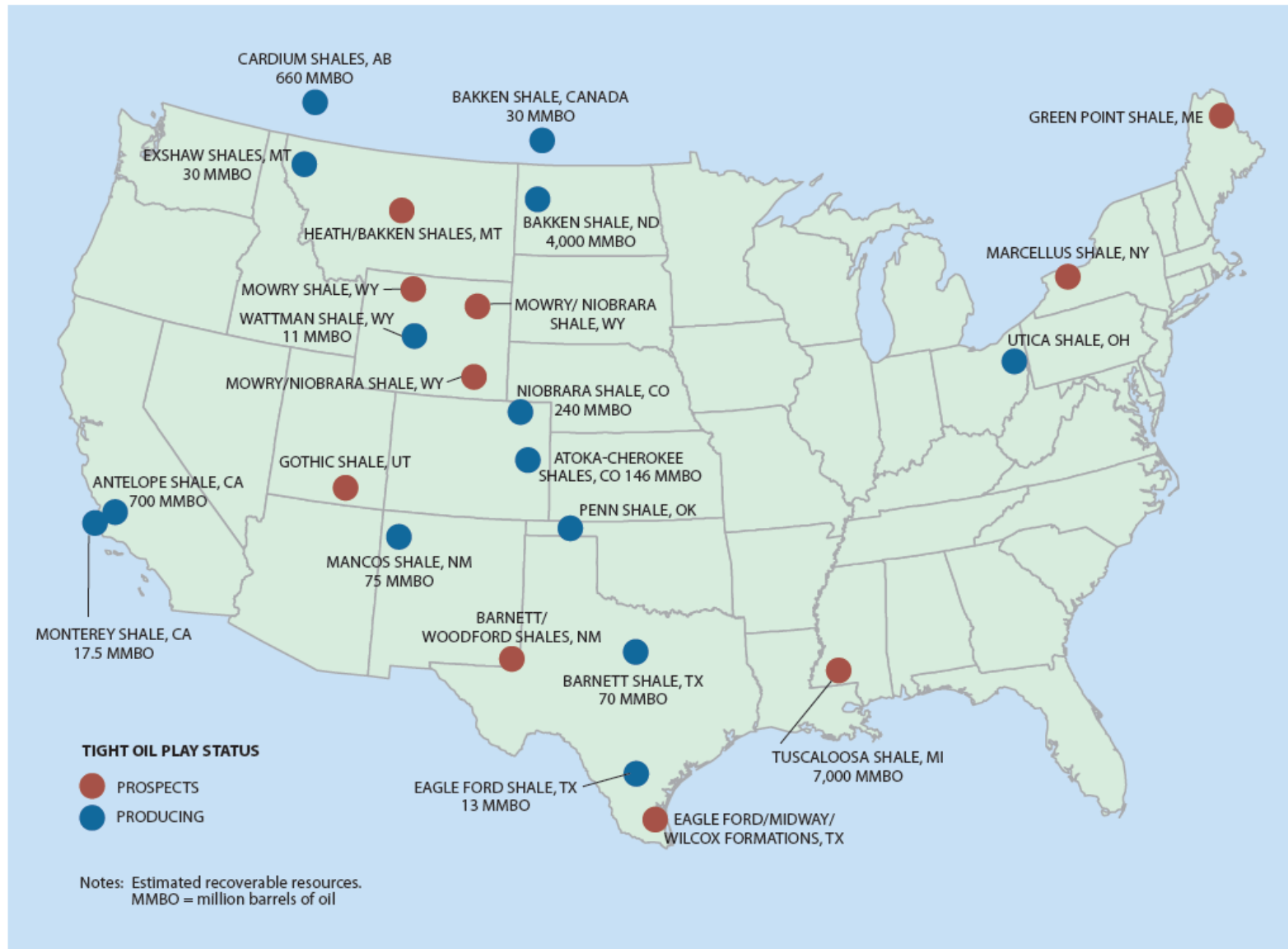


Some Tight Oil characteristics

- **Hydrocarbon liquids found in deep (non-mineable), low permeability rock formations**
 - shales, siltstones, sandstones and carbonates
 - usually light sweet crude
- **Sometimes goes by other names**
 - Light tight oil (LTO); shale oil; shale liquids; oil from shale
 - Not oil shale or kerogen
- **Resource unlocked by technology application similar to shale gas**
 - horizontal drilling
 - multi stage hydraulic fracturing
 - pad drilling
- **First mover play was the Bakken, in North Dakota, Manitoba, Montana and Saskatchewan – has ramped to about 450000 b/d in three years**
- **Other plays are fast followers - Eagle Ford, Niobrara, Permian, Utica...**

Unconventional Oil in NPC Study

Producing and Prospective Tight Oil Plays in the U.S. and Canada



Challenges and Enablers

Challenges

- More regulation on hydraulic fracturing
- Restrictions on access to or use of water
- Regulatory capacity
- Increased regulatory compliance cost
- Infrastructure

Enablers

- Continuous improvement in technology
 - recovery factors, well productivity, lower cost
- Access
- Enhanced regulatory capacity

National Petroleum Council

Prudent Development

Realizing the Potential of North America's Abundant
Natural Gas and Oil Resources

Focus on Tight Oil

CSIS

*Washington DC
December 7, 2011*