# Hydrocarbon Resources and Prospects of Exploration and Development, Northeast Asia

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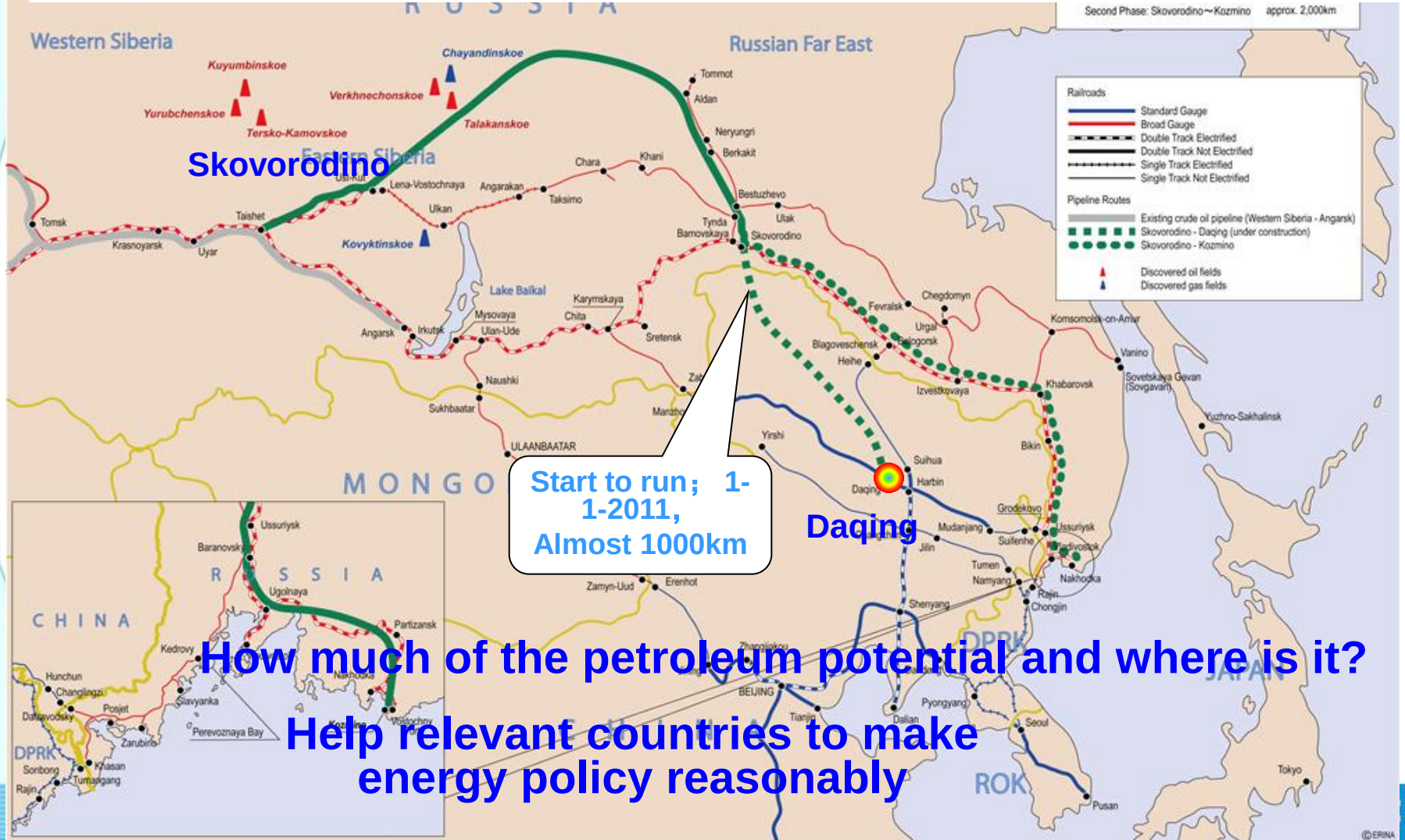
**2011**

# Outline

- Introduction
- Overview of Northeast Asia
- Distribution of hydrocarbon reserves, Northeast Asia
- Status of exploration and development, Northeast Asia
- Prospects of petroleum exploration and development
- Conclusion

# Introduction

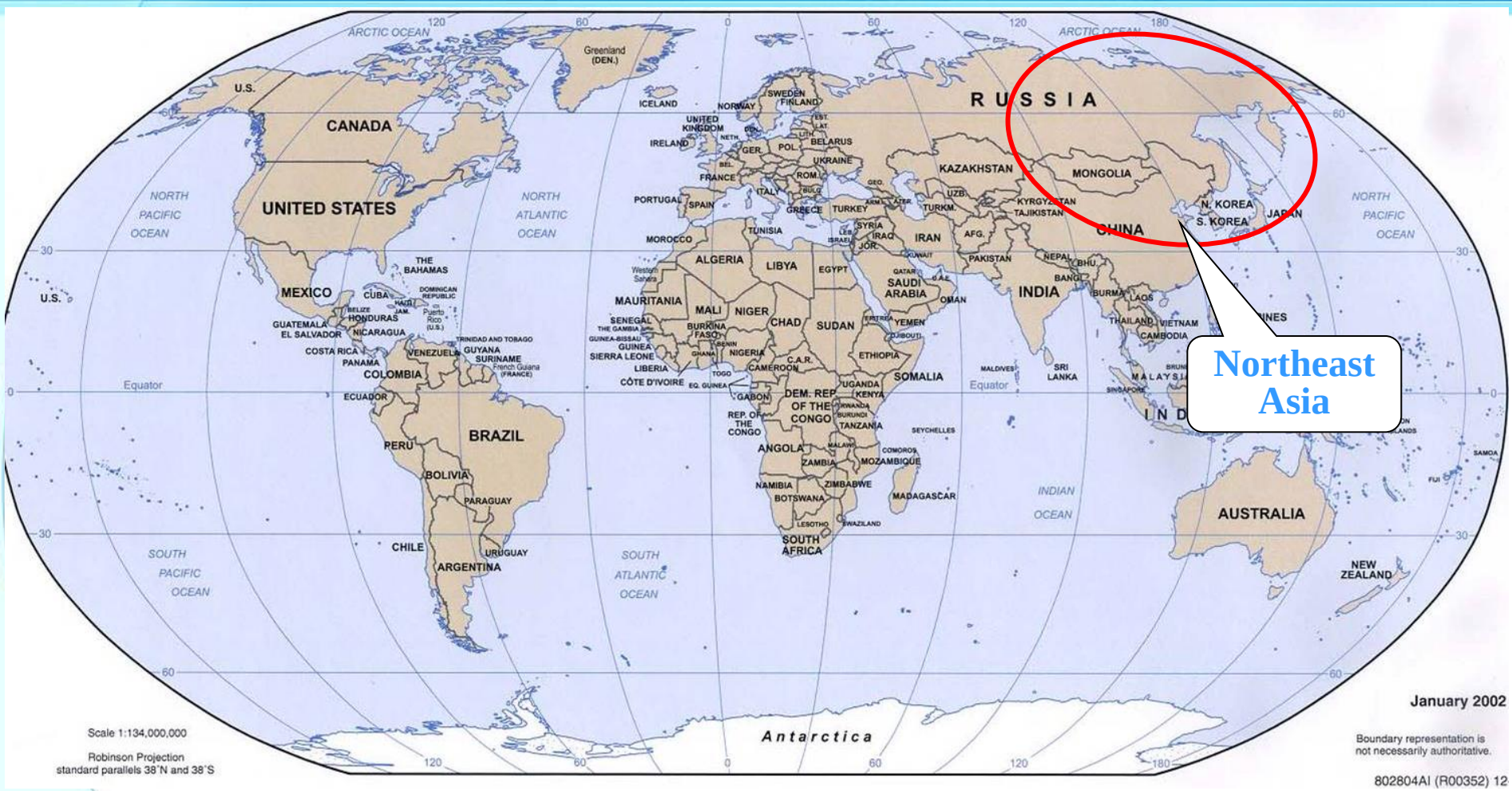
**Fast economic development, close link of energy interests, uneven distribution of resources**




**How much of the petroleum potential and where is it?**

**Help relevant countries to make energy policy reasonably**

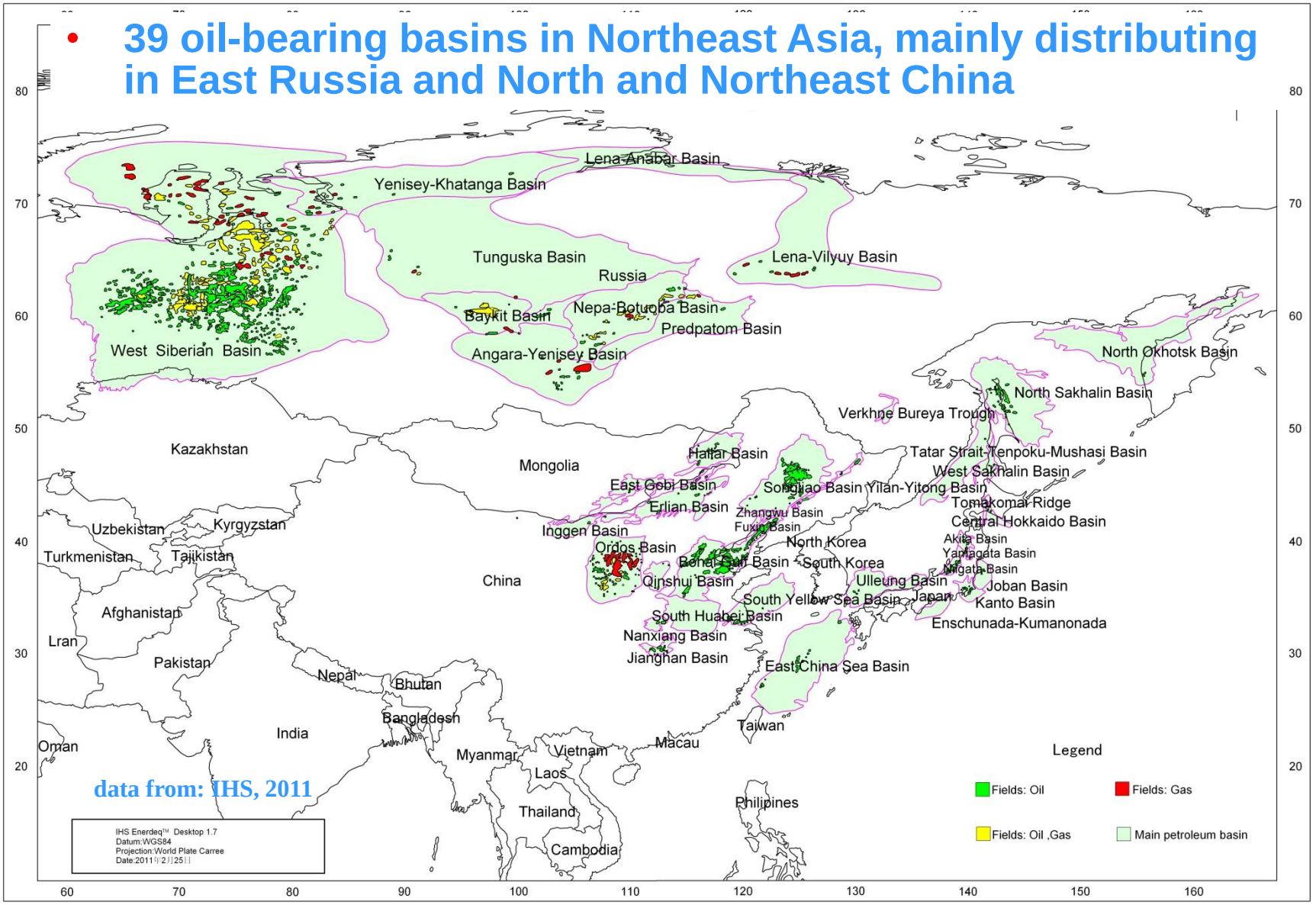
# Overview of Northeast Asia




**Including：North and Northeast China, East Russia, Mongolia, North Korea ,South Korea and Japan**

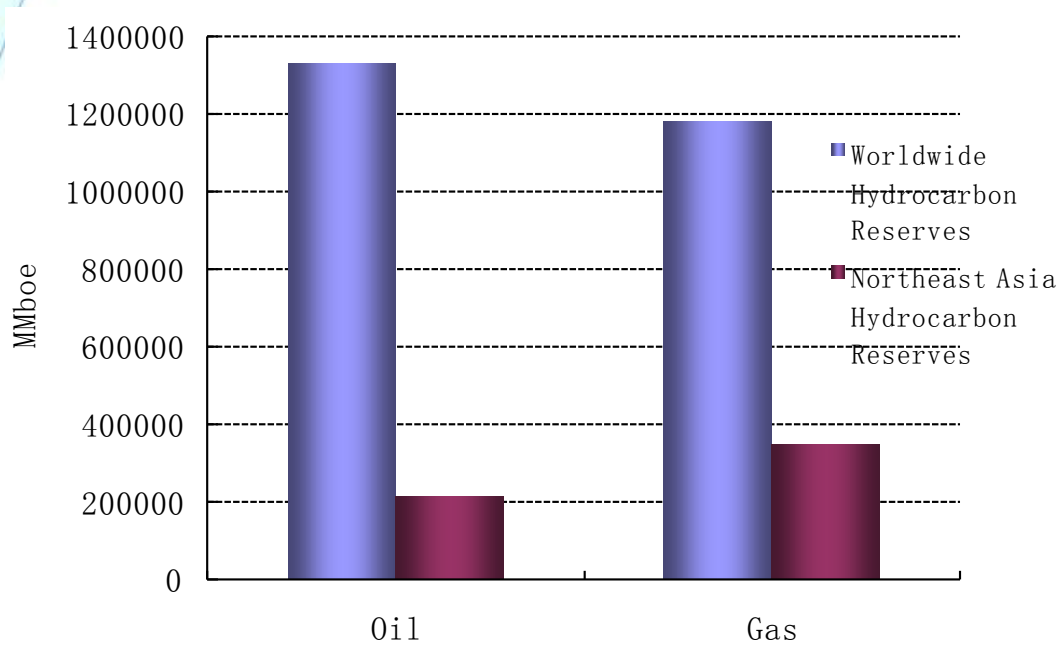
# Overview of Northeast Asia

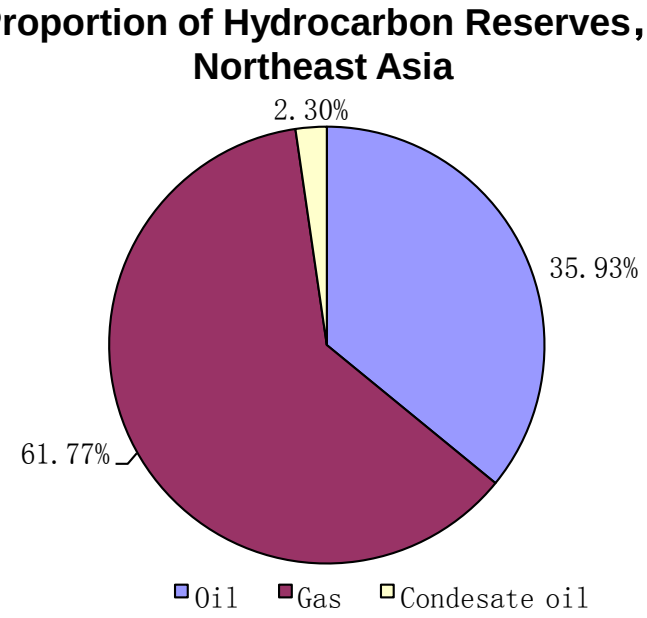
- **39 oil-bearing basins in Northeast Asia, mainly distributing in East Russia and North and Northeast China**



# Distribution of Hydrocarbon Reserves

## Composition of Hydrocarbon Reserves, Northeast Asia

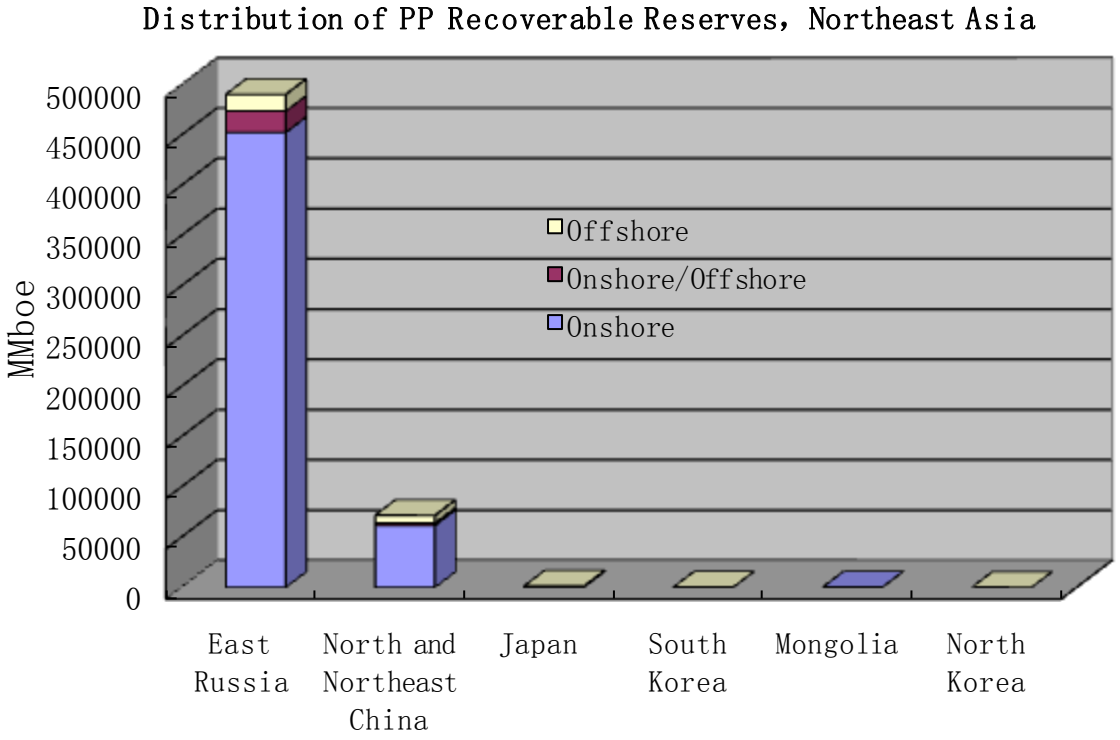


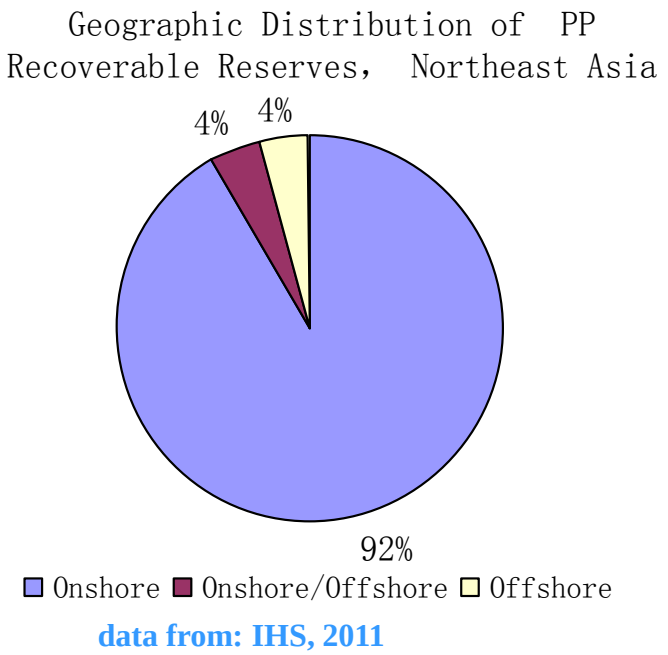




data from: IHS&BP, 2011

- Northeast Asia PP recoverable reserves:
  - Liquid oil 215.44Bn bbl, Gas: 55.35Tcf;
  - Proportion of the world:16.16% and 29.52%
- One of the richest petroleum accumulation areas

# Distribution of Hydrocarbon Reserves



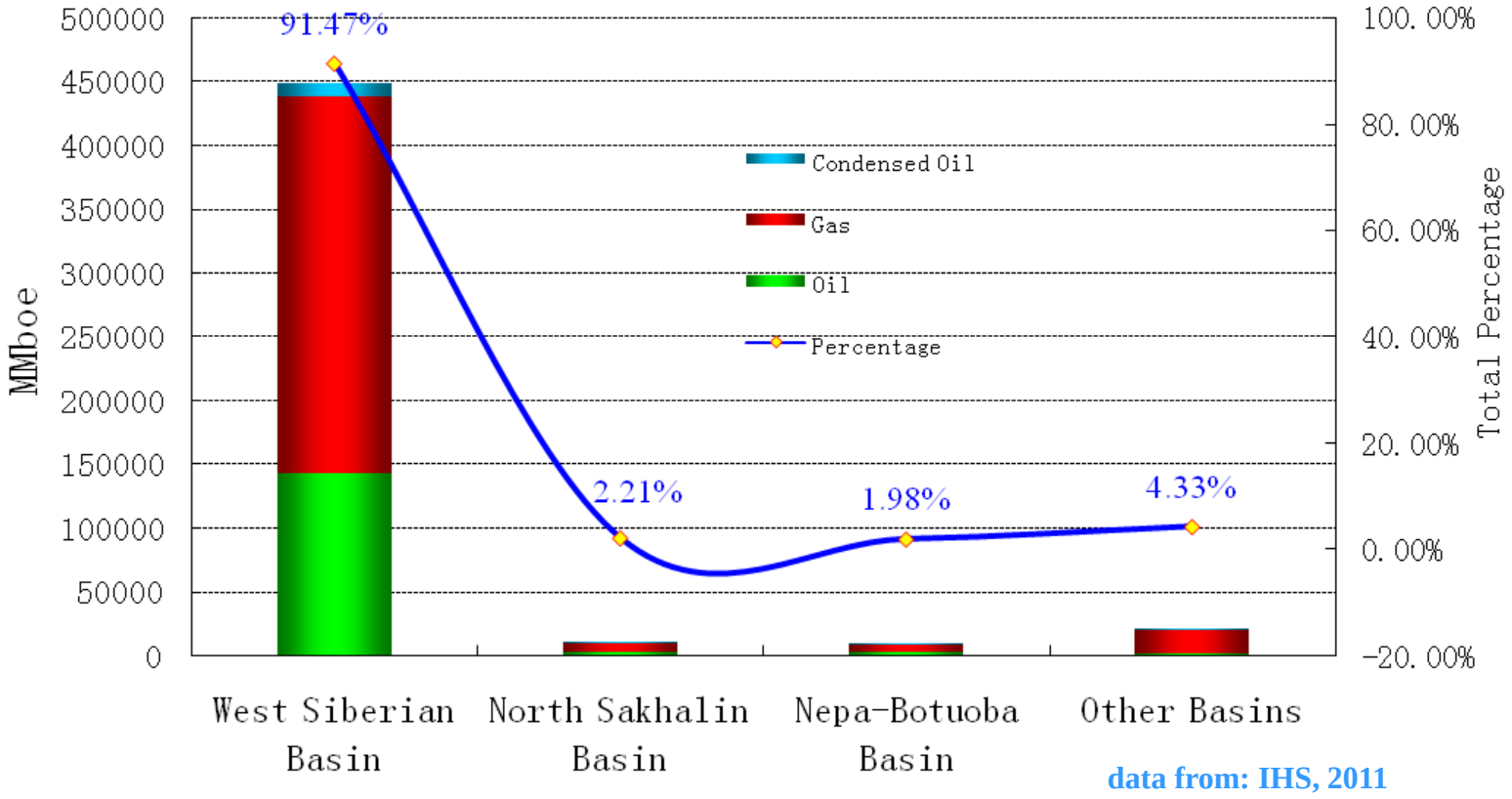




data from: IHS, 2011

- ✓ **Onshore of East Russia, North and Northeast China are the main petroleum accumulation areas**
- ✓ **A small quantity of reserves are discovered in Mongolia and Korean Peninsula**

# Distribution of Hydrocarbon Reserves

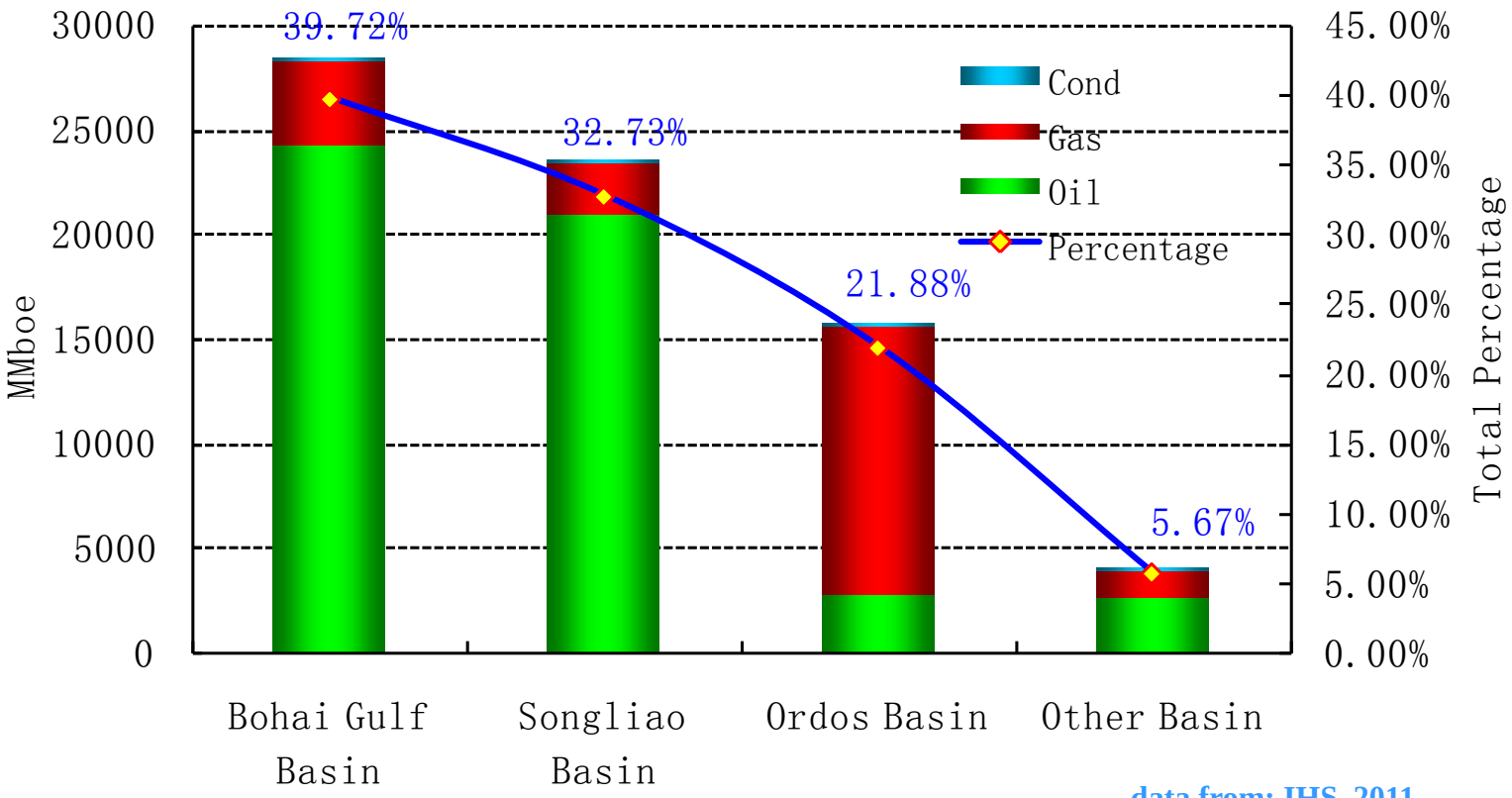
## Distribution of PP Recoverable Reserves, East Russia




data from: IHS, 2011

# Distribution of Hydrocarbon Reserves

## Distribution of PP Recoverable Reserves
## North and Northeast China

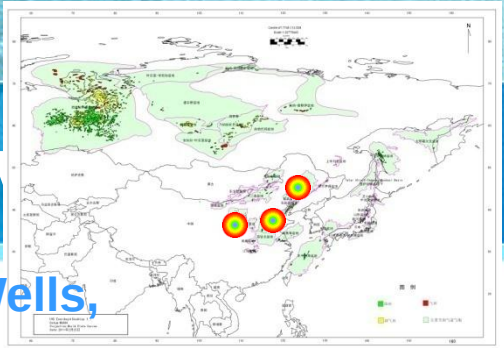



data from: IHS, 2011

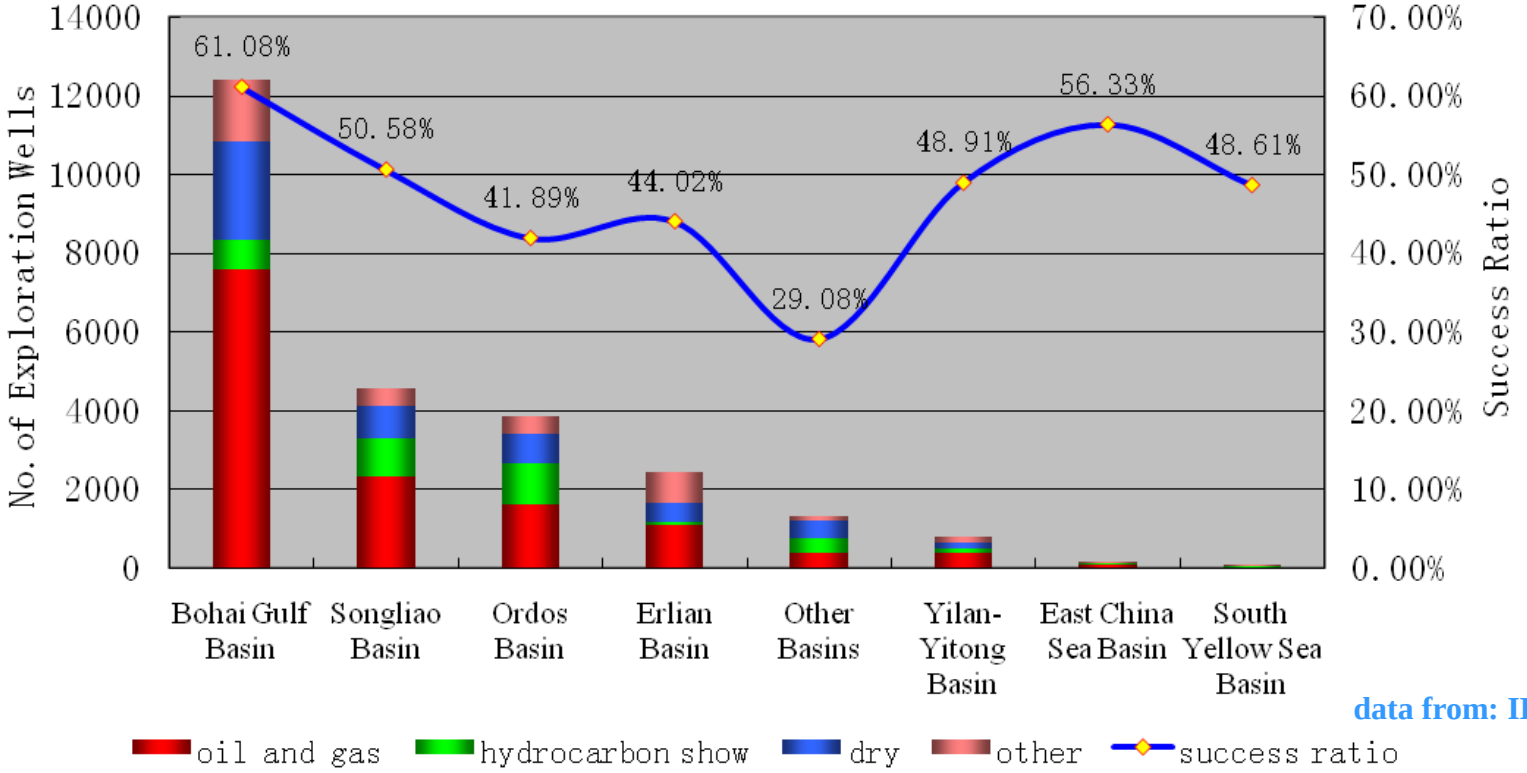
# Status of Exploration and Development

- 39 oil-bearing basins have been explored and developed in Northeast Asia;
- Up to now, 59000 wells have been drilled, containing 49000 exploration wells
- Exploration wells mainly distribute in East Russia, North and Northeast China, occupying the proportion: 51.92% and 46.54%

# Status of Exploration and Dev



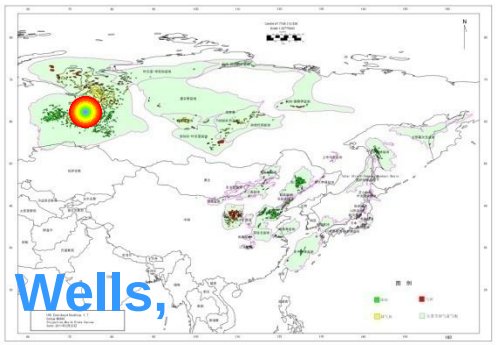
## Distribution and Content of the Exploration Wells, North and Northeast China



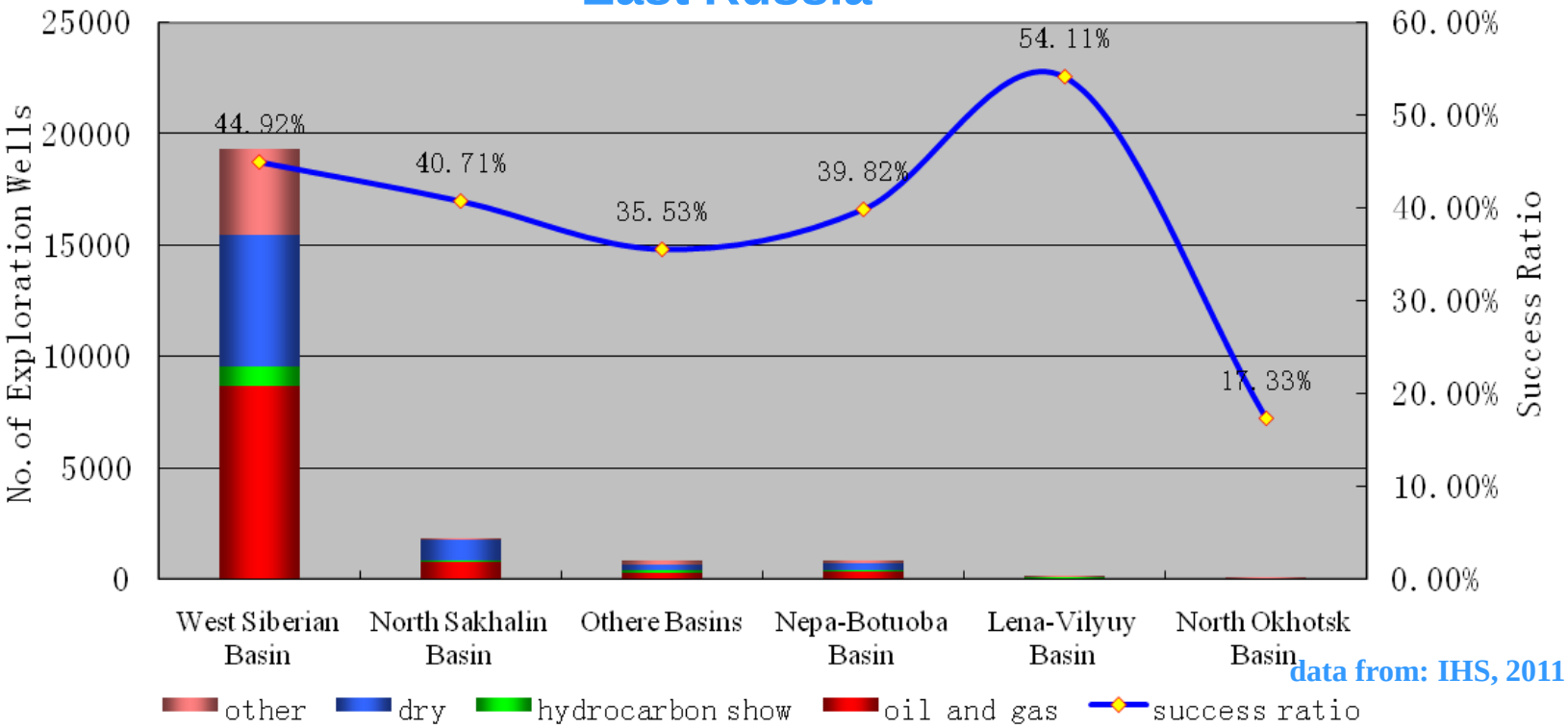

data from: IHS, 2011

- Concentrated in 3 areas; average success ratio: 43%
- Not high exploration maturity, e.g. Songliao Basin drilling density: 0.018 wells/km$^2$

# Status of Exploration and Dev



## Distribution and Content of the Exploration Wells, East Russia

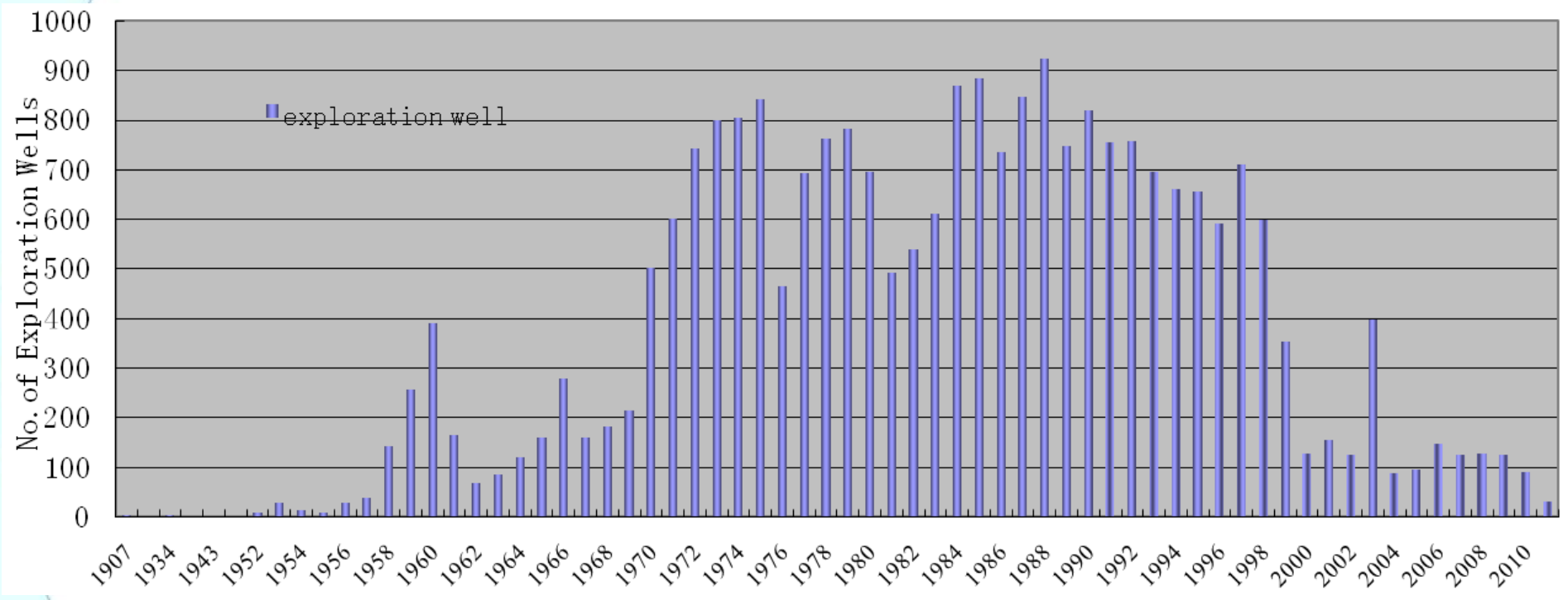



data from: IHS, 2011

- Concentrated in West Siberia; occupying local proportion: 86%
- Lower exploration maturity, e.g. West Siberia Basin drilling density: 0.008 wells/km$^2$, average success ratio: 40%

# Status of Exploration and Development

## Annual New Exploration Wells, North and Northeast China

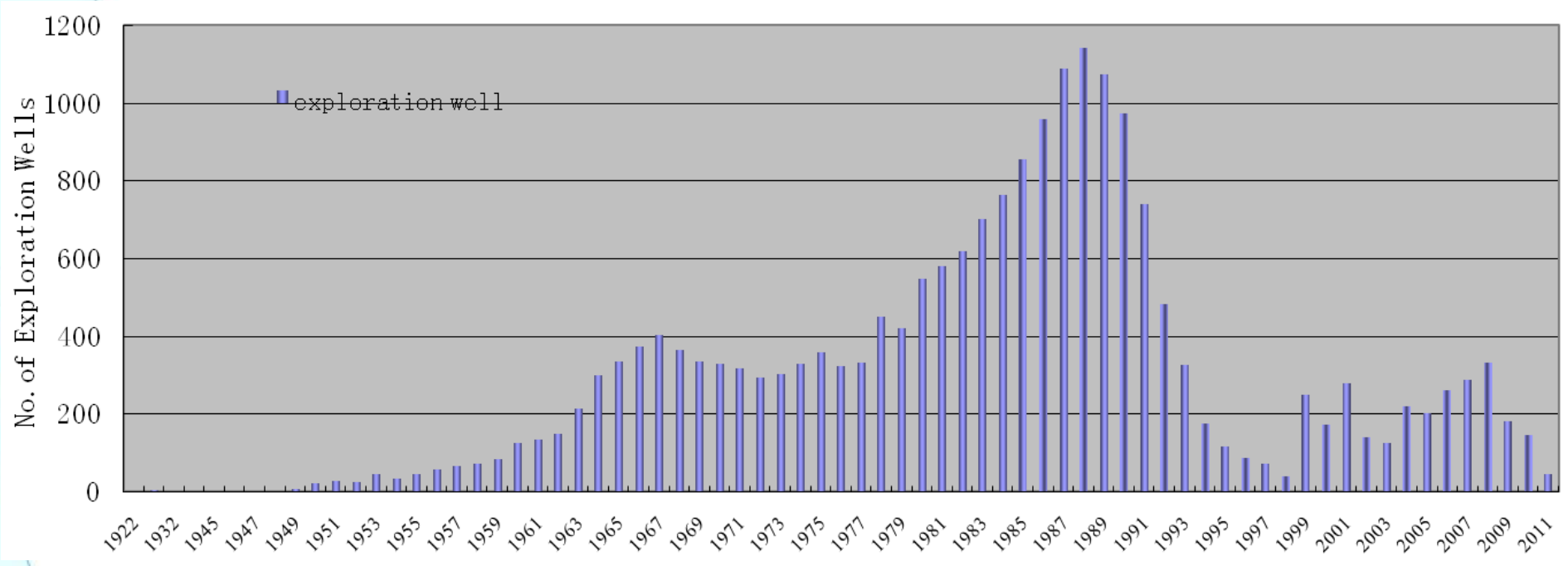



data from: IHS, 2011

- 1970s and 1990s are the peak periods of drilling
- During the last 10 years, drilling was not active

# Status of Exploration and Development

## Annual New Exploration Wells, East Russia

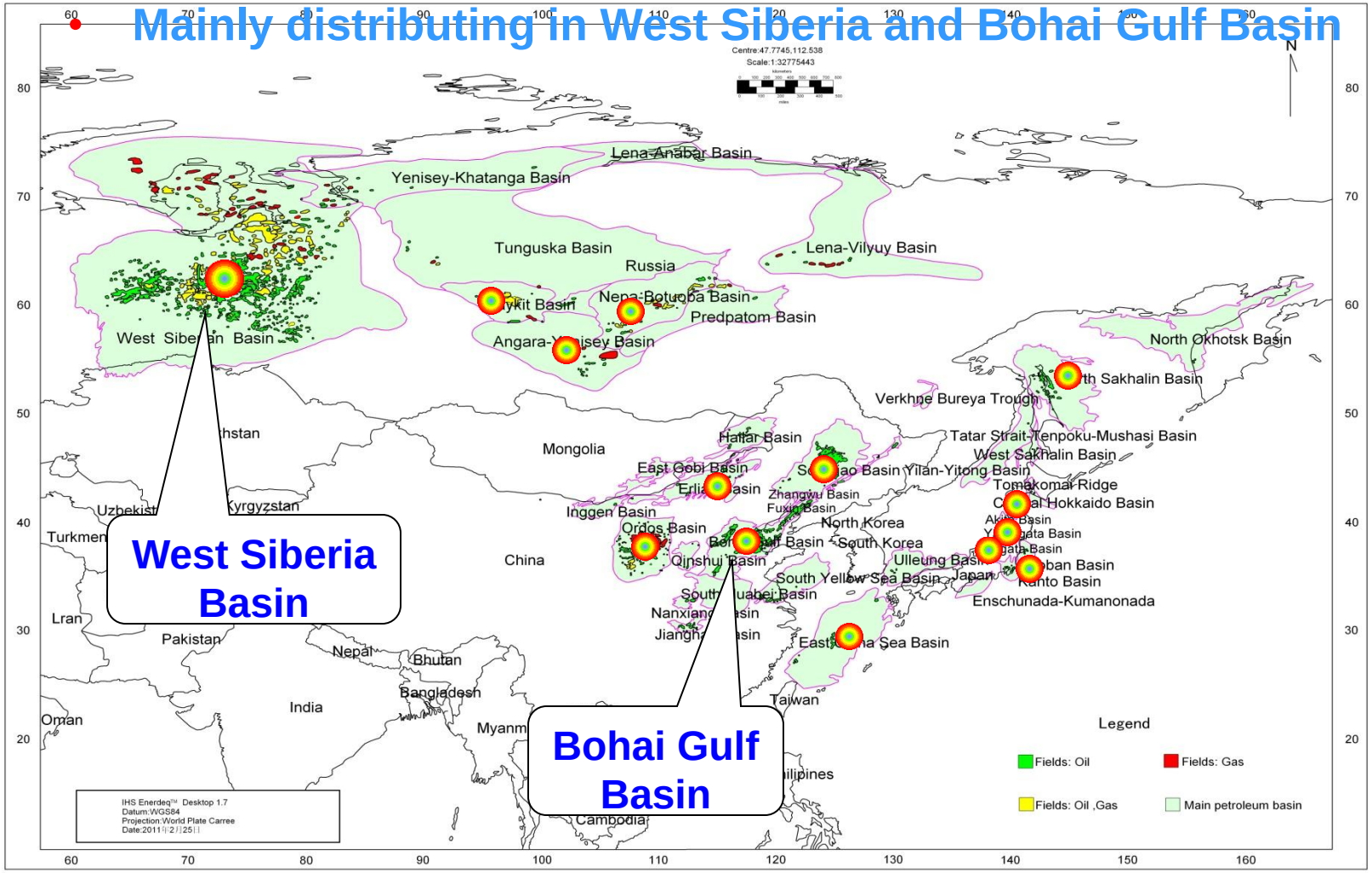



data from: IHS, 2011

- The end of 1980s is the maximum one in 3 drilling peaks
- During the last 5 years, drilling was relatively active

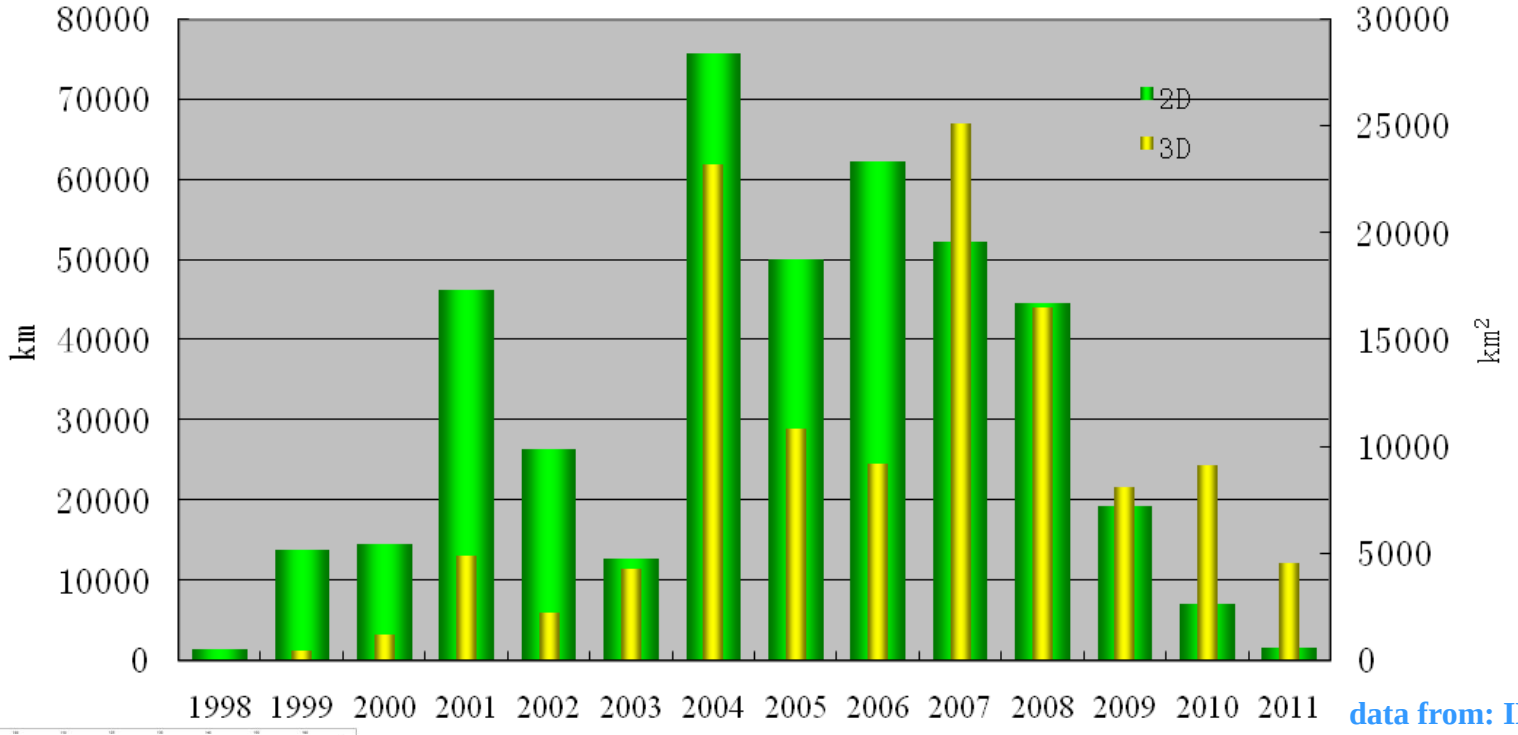
# Status of Exploration and Development

- Seismic lines have been acquired in 14 important basins
- Up to 2011: 2D:916000km, 3D:236000km$^2$
- Mainly distributing in West Siberia and Bohai Gulf Basin

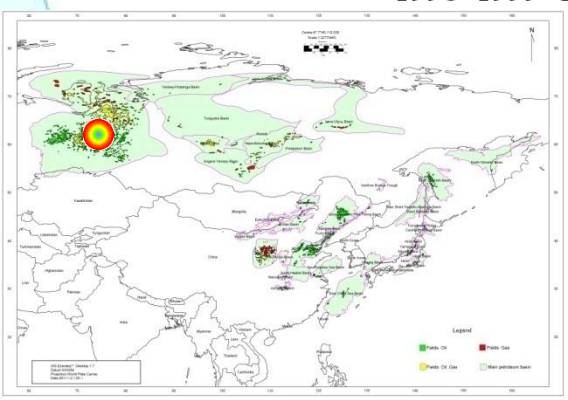


# Status of Exploration and Development

## Annual New Seismic Acquisition, West Siberia Basin



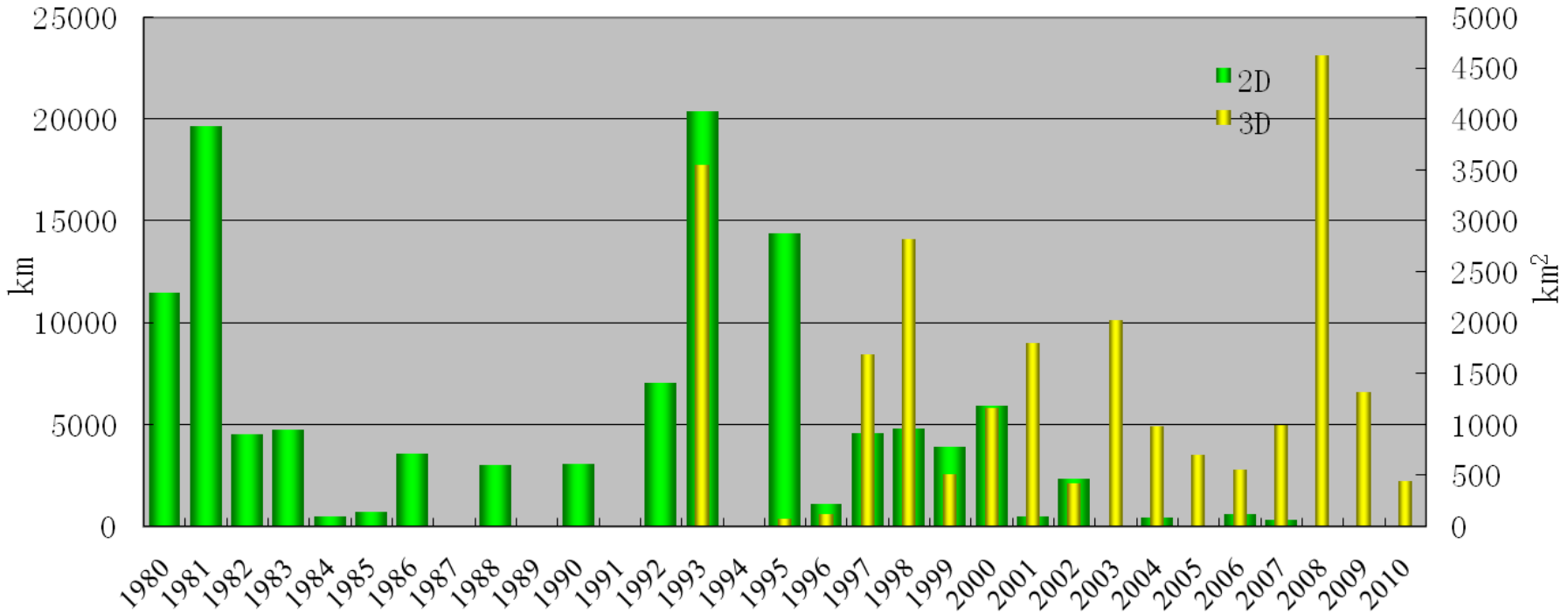

data from: IHS, 2011



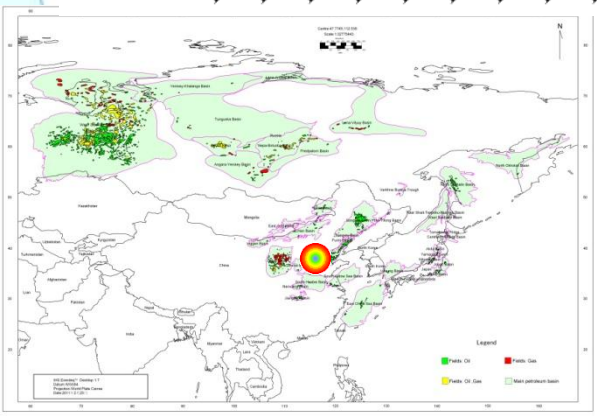
- Total seismic acquisition: 2D:427000 km； 3D：120000 km$^2$
- The last 5 years is the peak stage for the 3D seismic acquisition

# Status of Exploration and Development

## Annual New Seismic Acquisition, Bohai Gulf Basin




data from: IHS, 2011

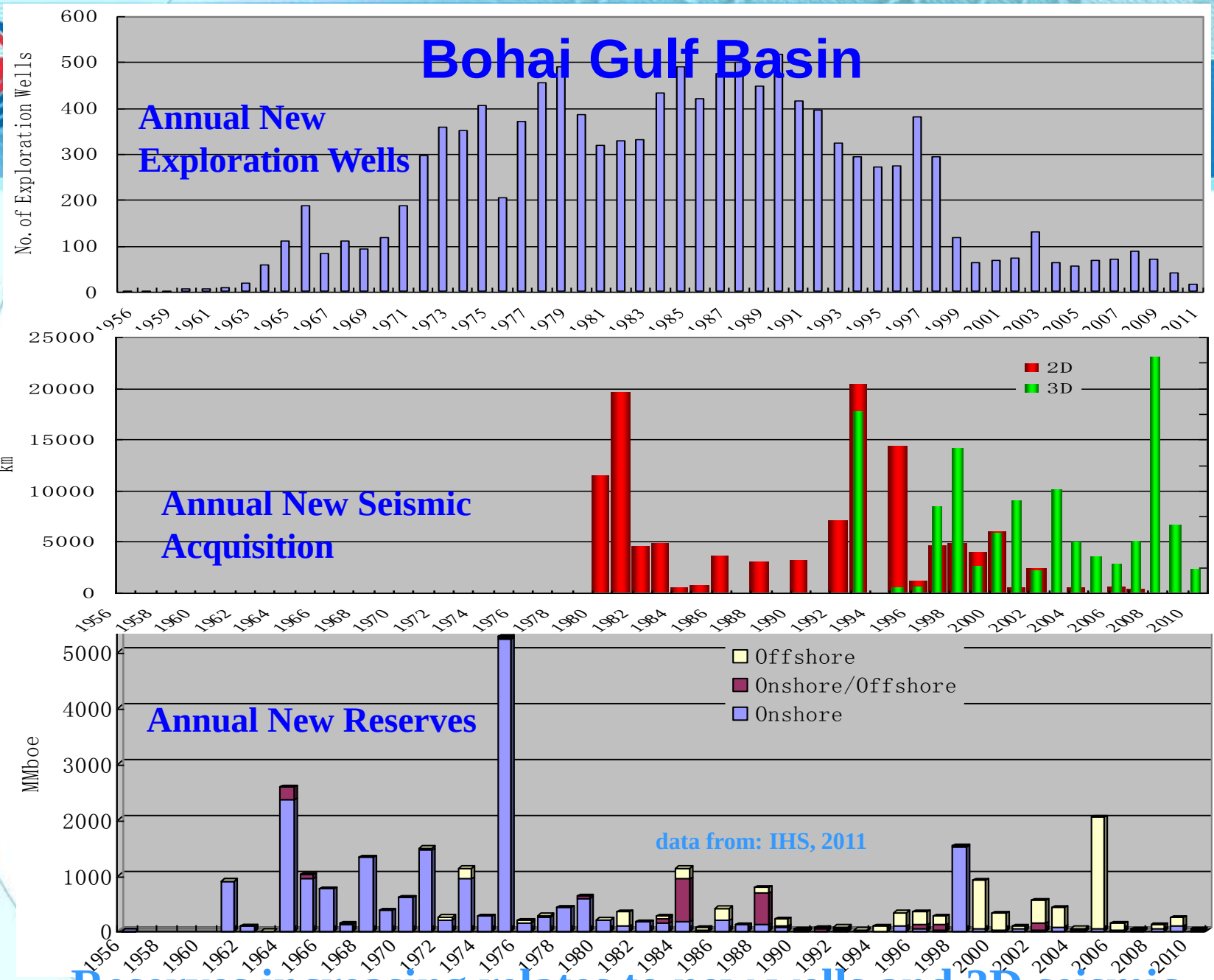


- Total seismic acquisition: 2D:117000km； 3D：24000km$^2$
- Mainly 3D seismic lines have been acquired for last 10 years

# Status of Exploration and Development

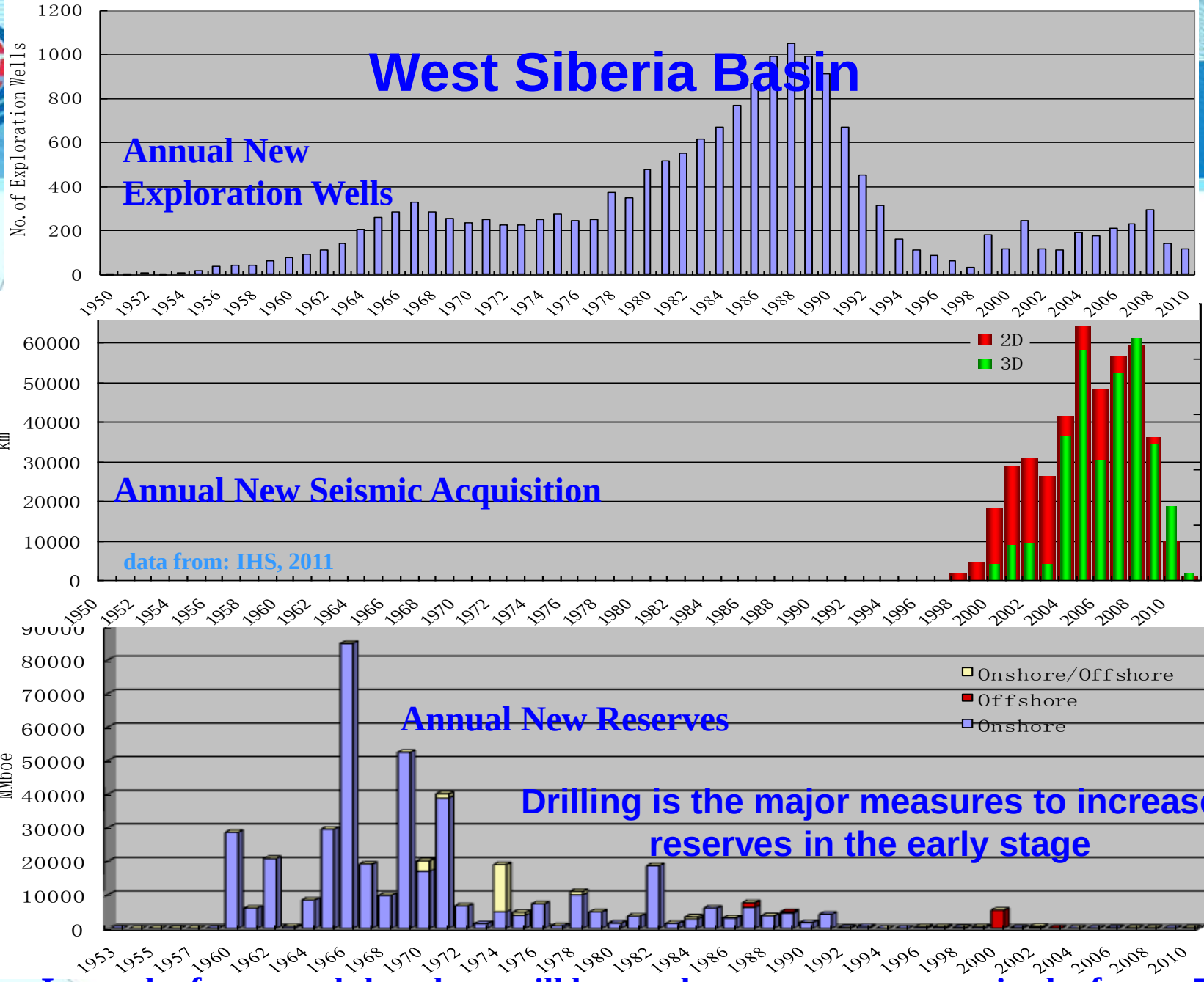
- For the high exploration maturity basins (e.g. Bohai Gulf Basin which drilling density is 0.05 wenlls/km$^2$), annual new exploration wells and 3D seismic are the main means for increasing reserves
- For the lower ones (e.g. West Siberia Basin which drilling density is 0.008 wenlls/km$^2$), adding new reserves always depends on new exploration wells

# Bohai Gulf Basin




**Reserves increasing relates to new wells and 3D seismic**

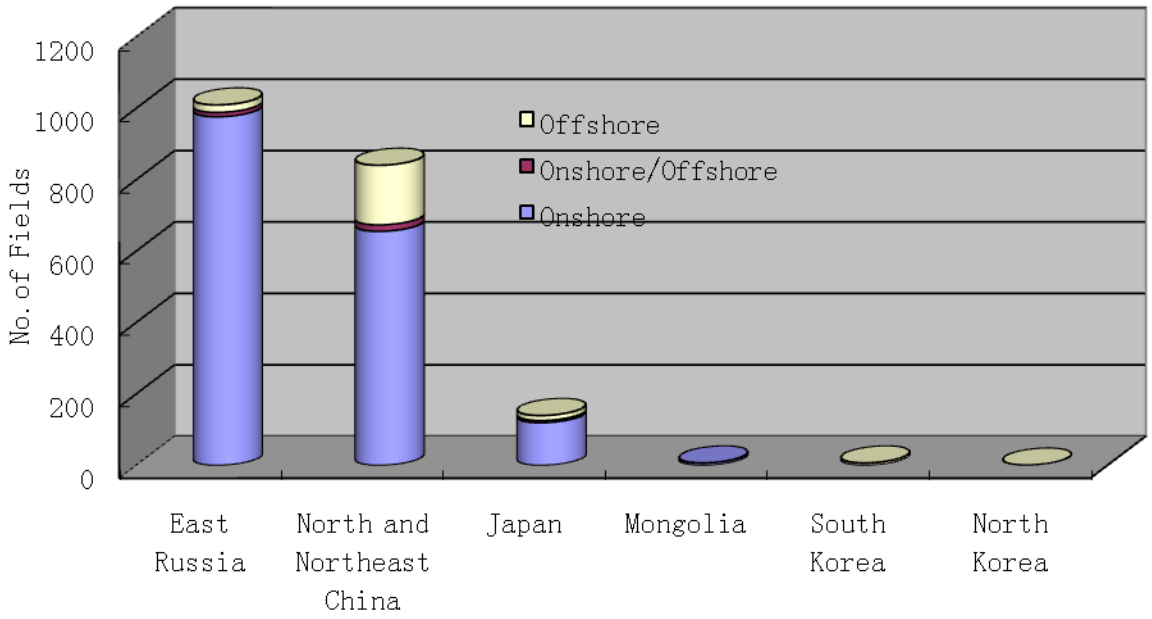
# West Siberia Basin



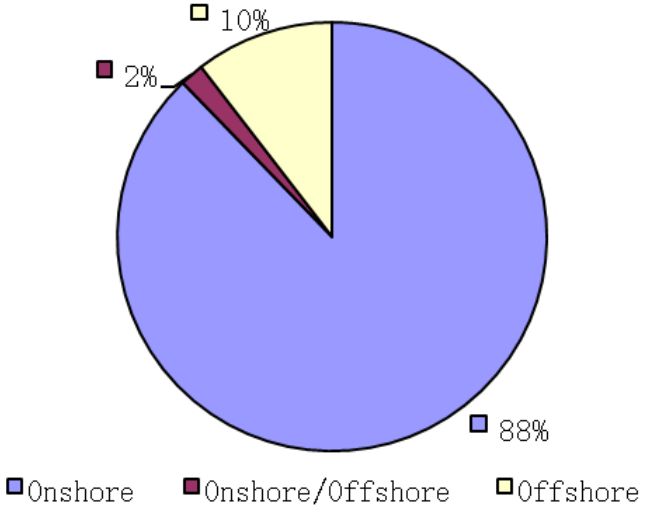

It can be forecasted that there will be much more new reserves in the future 5 years

# Status of Exploration and Development

## Geographic Distribution of Fields, Northeast Asia




**Distributed Proportion of Fields**

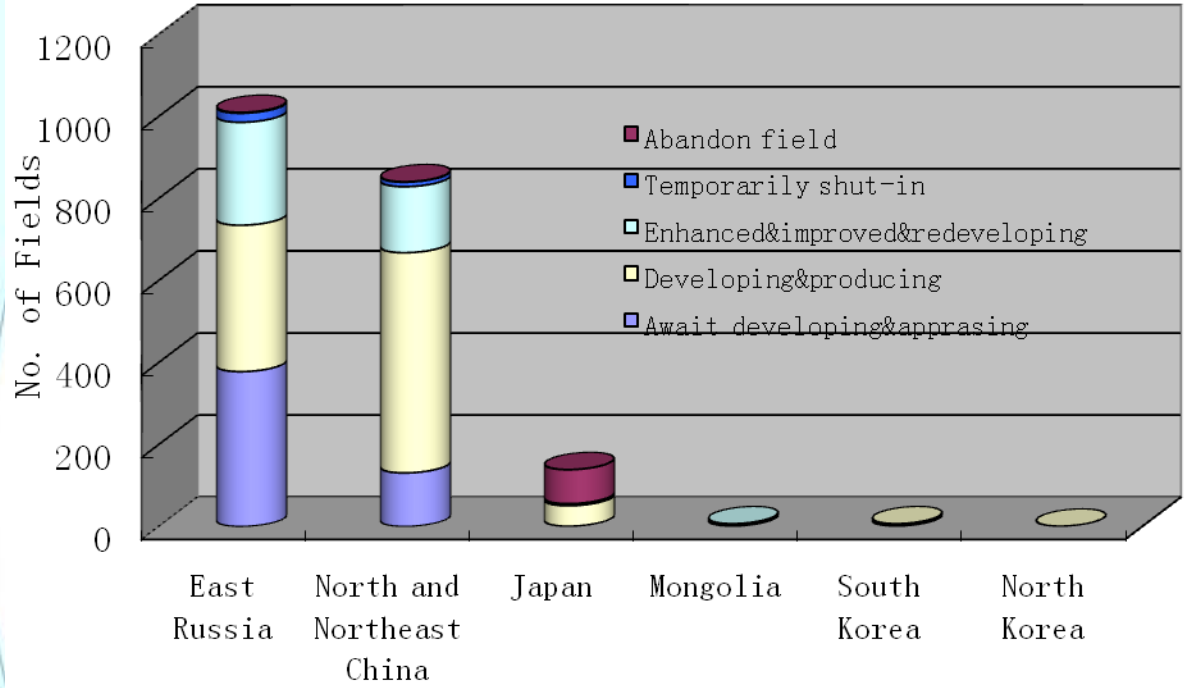



data from: IHS, 2011

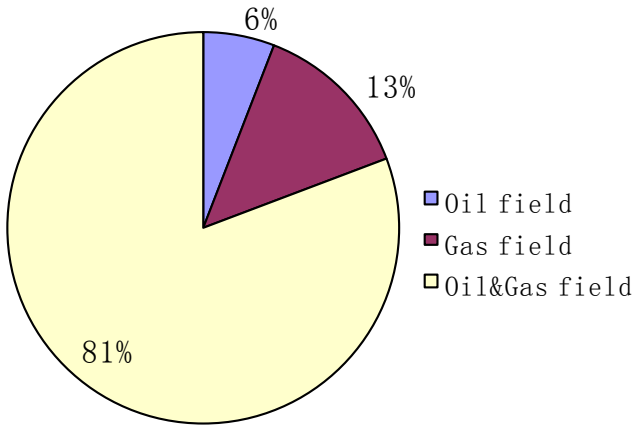
- About 2000 producing fields mainly distribute in East Russia and North and Northeast China
- 88% of them are located onshore

# Status of Exploration and Development

## Production Status of Fields, Northeast Asia




**Hydrocarbon Type Proportion of Fields, Northeast Asia**

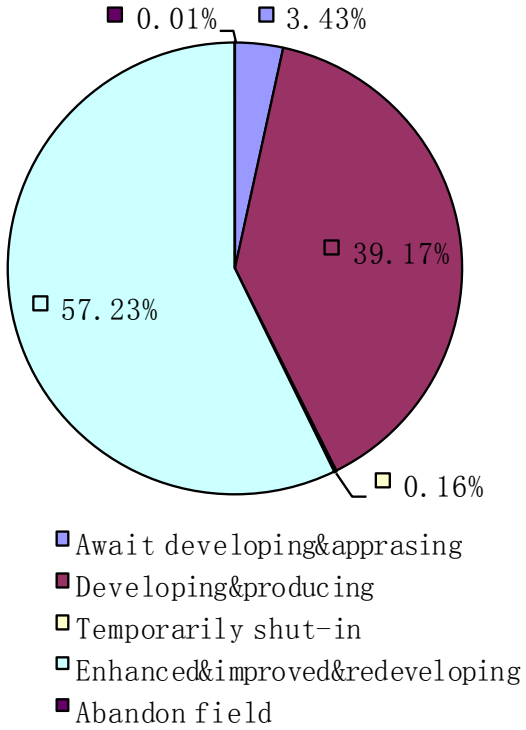



data from: IHS, 2011

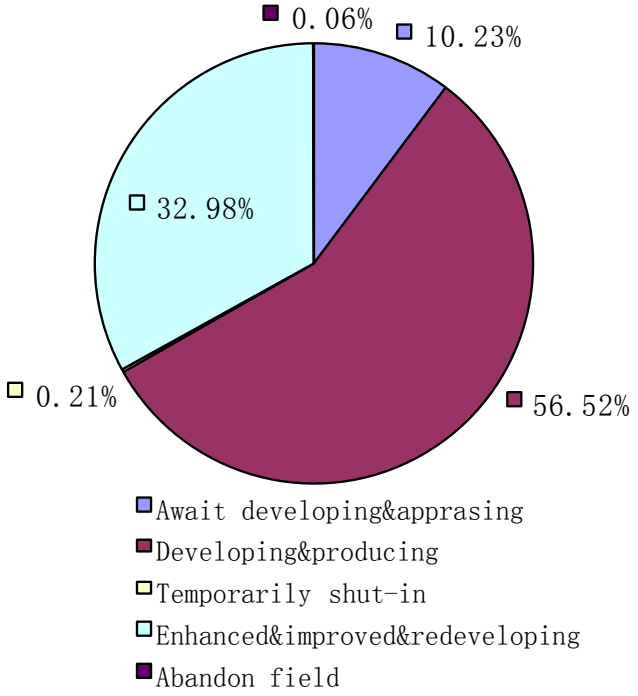
- The fields in East Russia and North & Northeast China are mostly in developing & producing and awaiting developing & appraising
- The proportion of pure oil or gas fields is not high

# Status of Exploration and Development

**Distributed Proportion of Recoverable Reserves, North and Northeast China**




**Distributed Proportion of Recoverable Reserves, East Russia**




data from: IHS, 2011

**Recoverable reserves mainly distribute in primary developing fields and other fields which have been taken measures for increasing production**

# Status of Exploration and Development

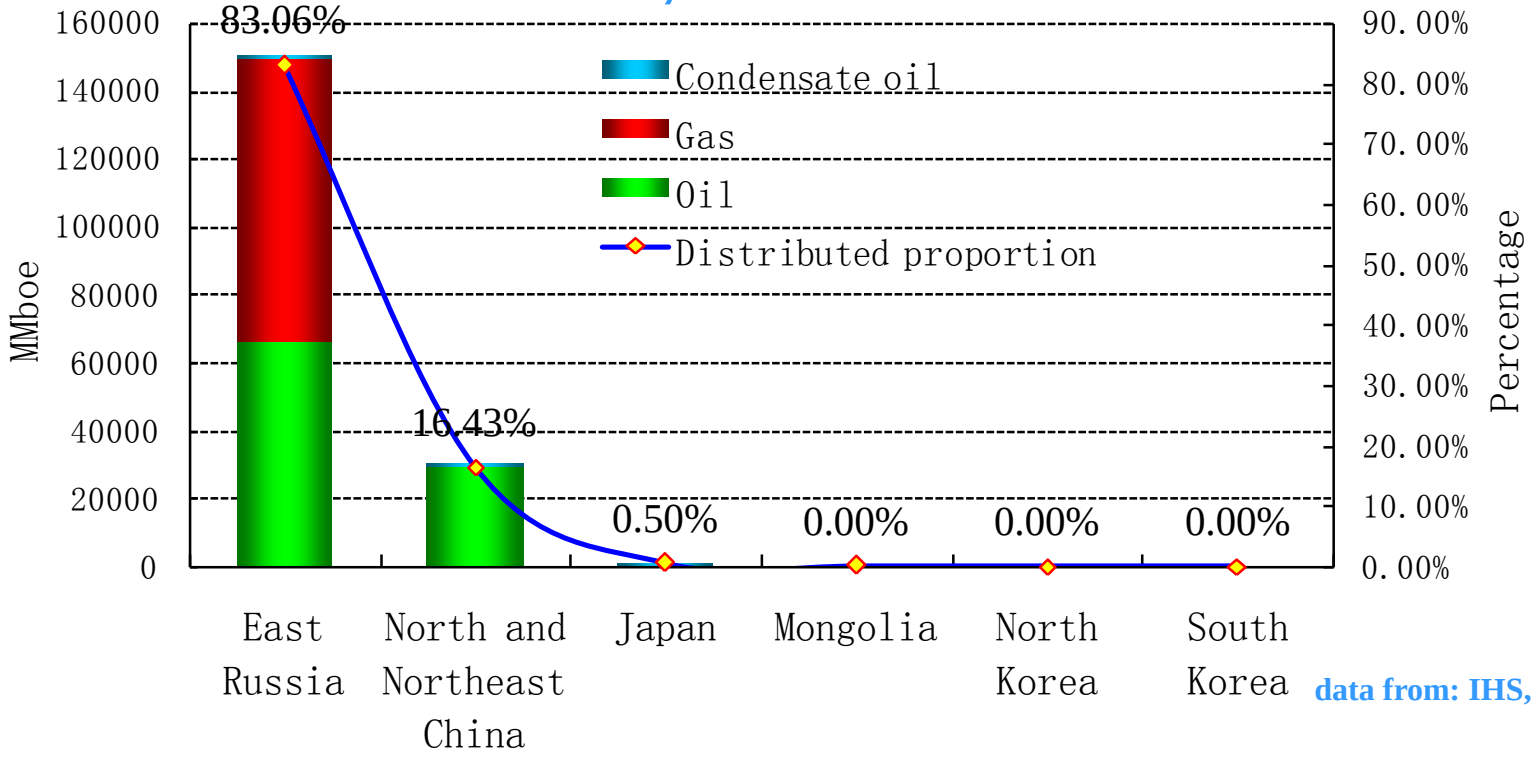
| Distribution of Cumulative Production in Northeast Asia | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Country/Area | Oil | | Gas | | | Condensate oil | | Total |
| | (MMbbl) | Recovery factor% | (MMscf) | (MMboe) | Recovery factor% | (MMbbl) | Recovery factor% | (MMboe) |
| East Russia | 66275.0654 | 6.5-62.3 | 4.81E+08 | 83008.84 | 40-100 | 1066.741 | 30-95 | 150350.6 |
| North and Northeast China | 28952.1376 | 3-55.67 | 4515089 | 778.4464 | 1-94 | 11.65736 | 19-70 | 29742.24 |
| Japan | 230.760322 | 5-50 | 3641735 | 627.8716 | 20-80 | 54.57736 | —— | 913.2093 |
| Mongolia | 5.1895 | 11.5-20 | | 0 | —— | 0 | —— | 5.1895 |
| North Korea | 0 | 10 | | 0 | —— | 0 | —— | 0 |
| South Korea | 0 | —— | 36.2 | 0.006241 | 60-67 | 0 | —— | 0.006241 |
| Sum | 95463.15282 | | 4.9E+08 | 84415.16 | | 1132.976 | | 181011.3 |

data from: IHS, 2011

- **Up to 2011, it has been producing 181.01billion barrels oil equivalent, containing oil(52.74%), gas(46.64%) and condensate oil(0.63%)**

# Status of Exploration and Development

## Distributed Characteristic of Cumulative Production, Northeast Asia

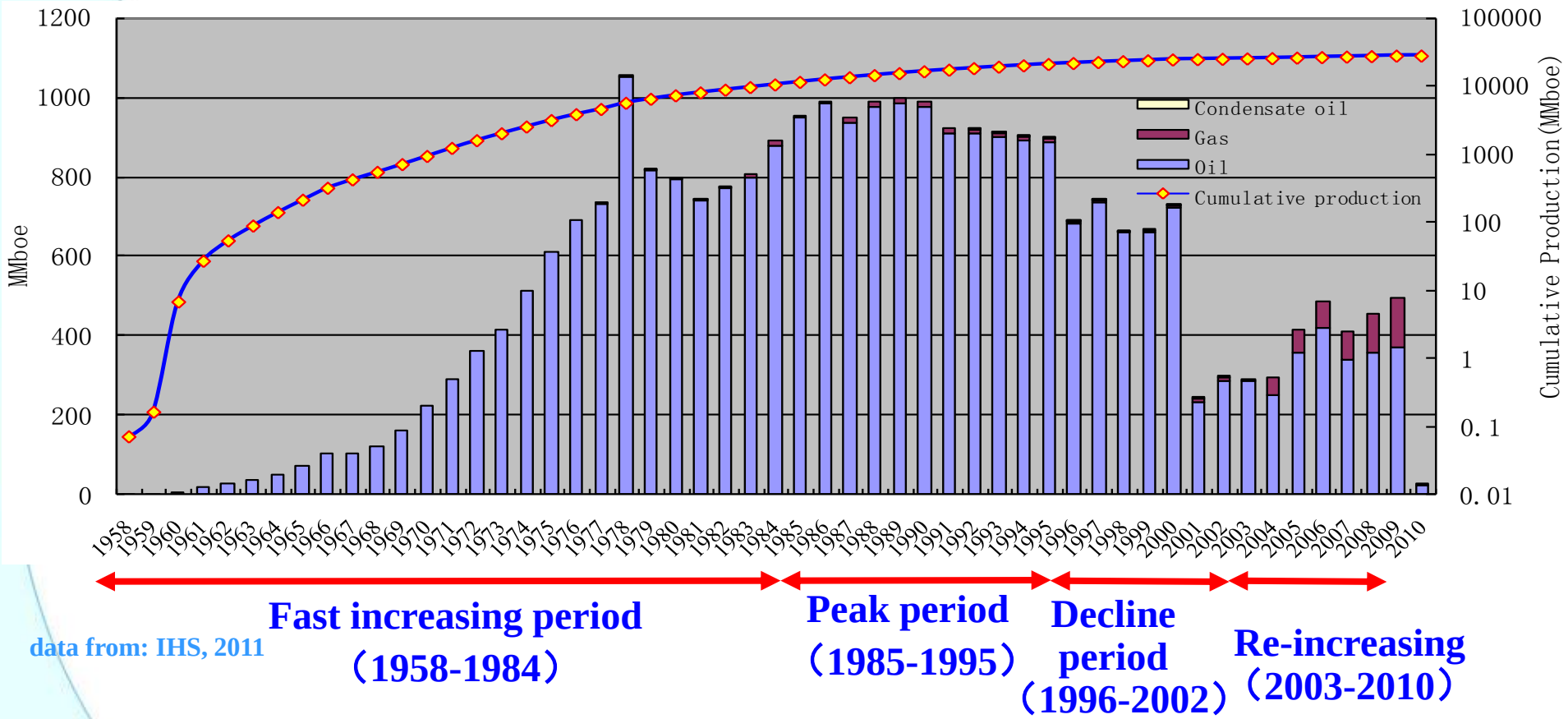



data from: IHS, 2011

**East Russia and North & Northeast China are the major production regions**

# Status of Exploration and Development

## Annual Production, North and Northeast China

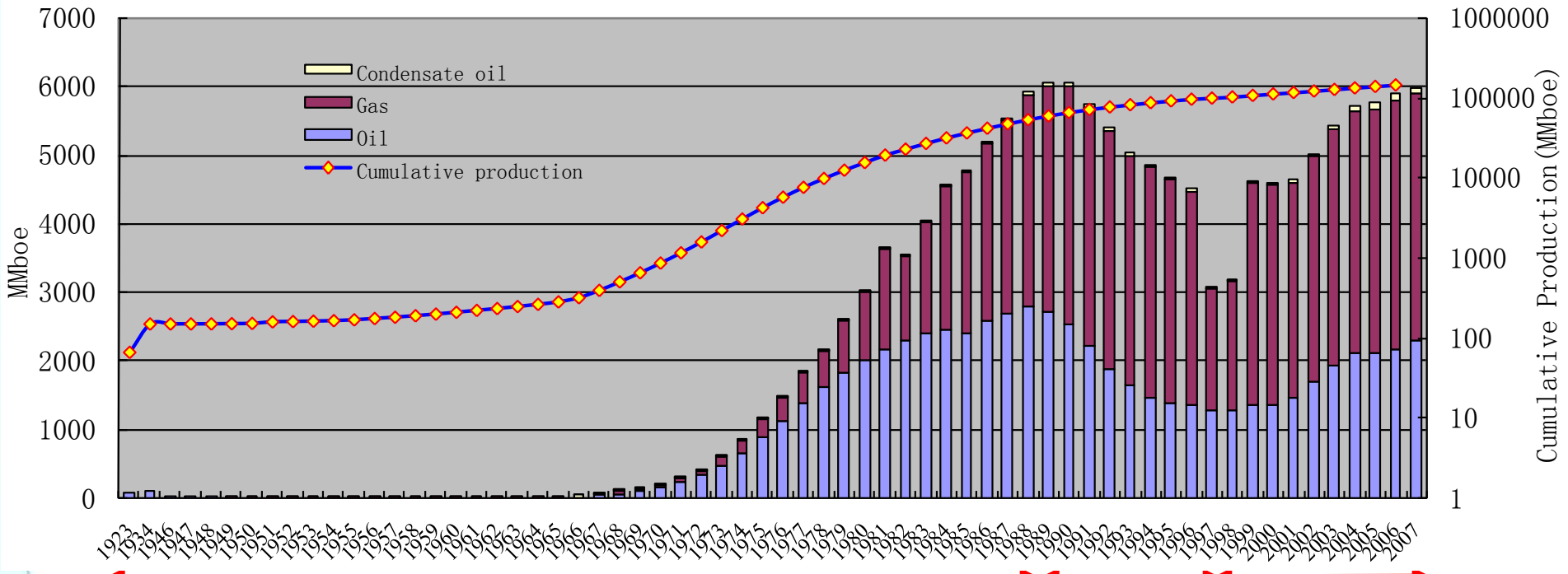



data from: IHS, 2011

After 2003, production is re-increasing, with the change of exploration direction and taking measures, e.g. infill drilling

# Status of Exploration and Development

## Annual Production, East Russia




**Fast increasing period (1923-1989)**

**Decline period (1990-1996)**

**Re-increasing (1997-2009)**

data from: IHS, 2011

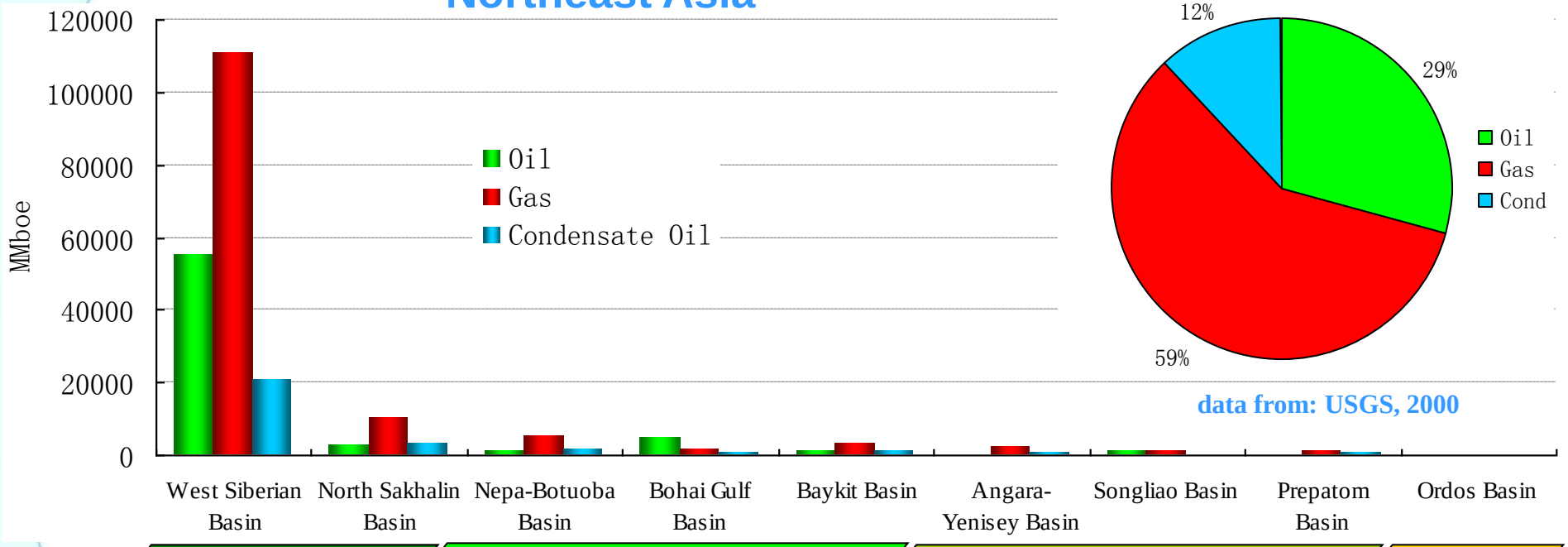
**At present, the production is quickly re- increasing in East Russia.**

# Summary

- Seismic and wells are mainly distributed in West Siberia and Bohai Gulf Basins, 1980s is the drilling peak period and it is relatively active during the last 5 years
- East Russia and North-Northeast China are the major regions of the oil & gas fields, and the cumulative production is holding about 83% of the Northeast Asia
- Although 1990s is the production peak period, the production is re-increasing in East Russia and North-Northeast China at present
- Most of the fields in East Russia are awaiting development or appraising and developing or producing

# Prospects of Exploration and Development

## Distribution of Undiscovered Resources, Northeast Asia





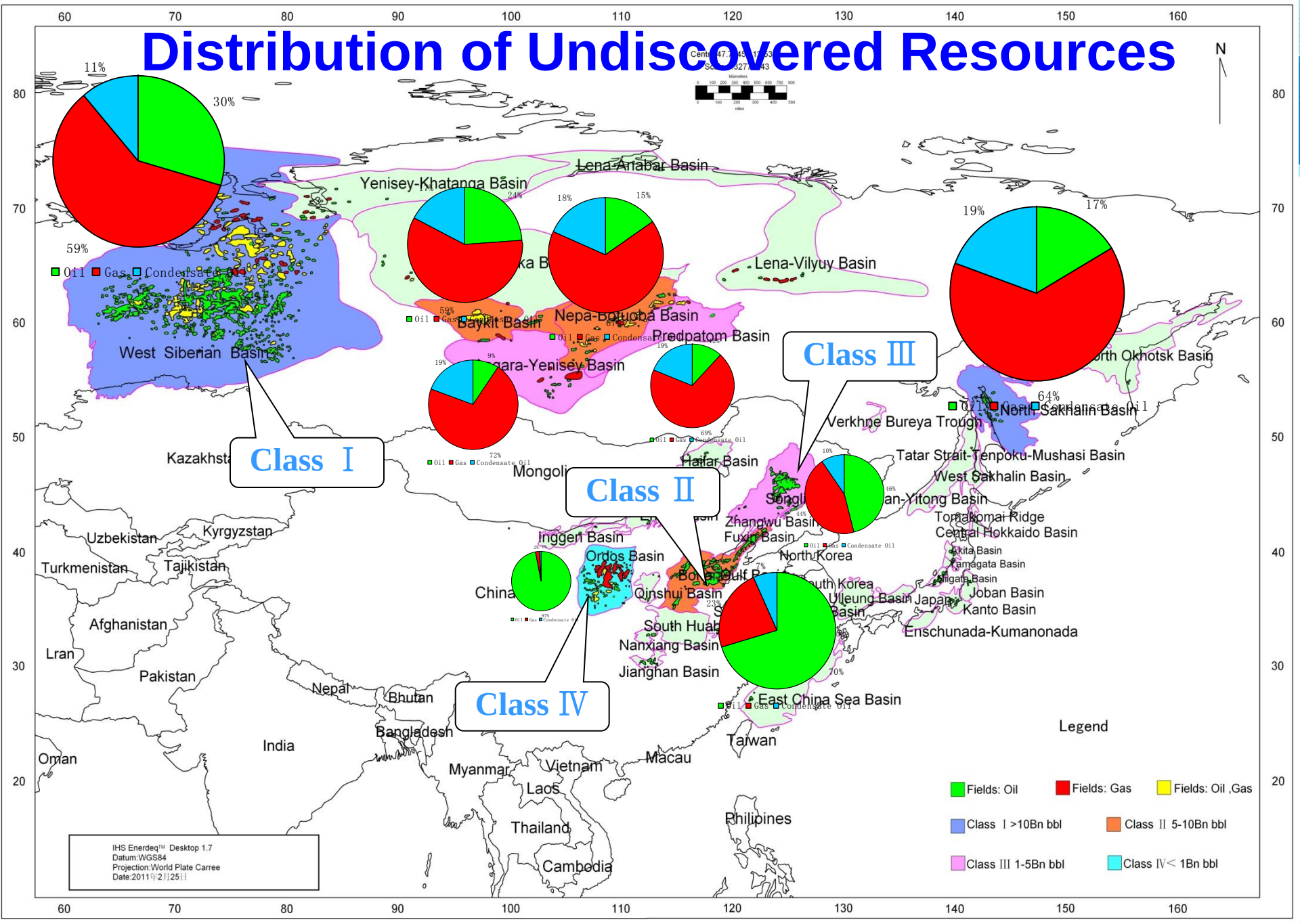


data from: USGS, 2000

| Class Ⅰ | Class Ⅱ | Class Ⅲ | Class Ⅳ |
|---|---|---|---|
| >10Bn bbl | 5~10Bn bbl | 1~5Bn bbl | <1Bn bbl |

- Class Ⅰ + Ⅱ are the main potential basins
- Major undiscovered resources: Gas

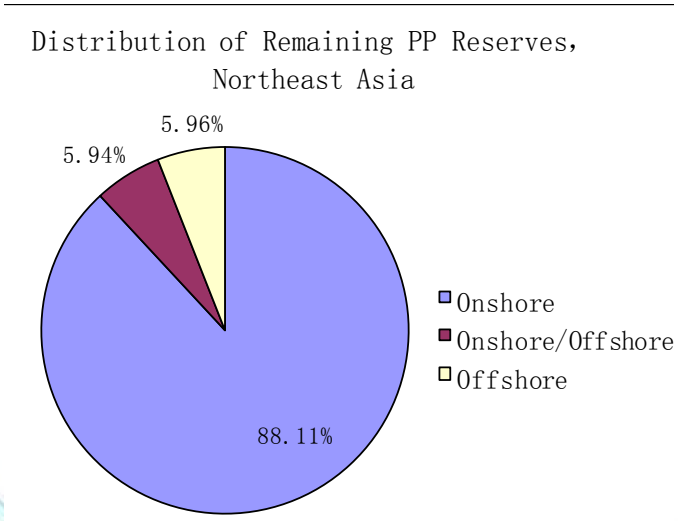
# Distribution of Undiscovered Resources



# Prospects of Exploration and Development

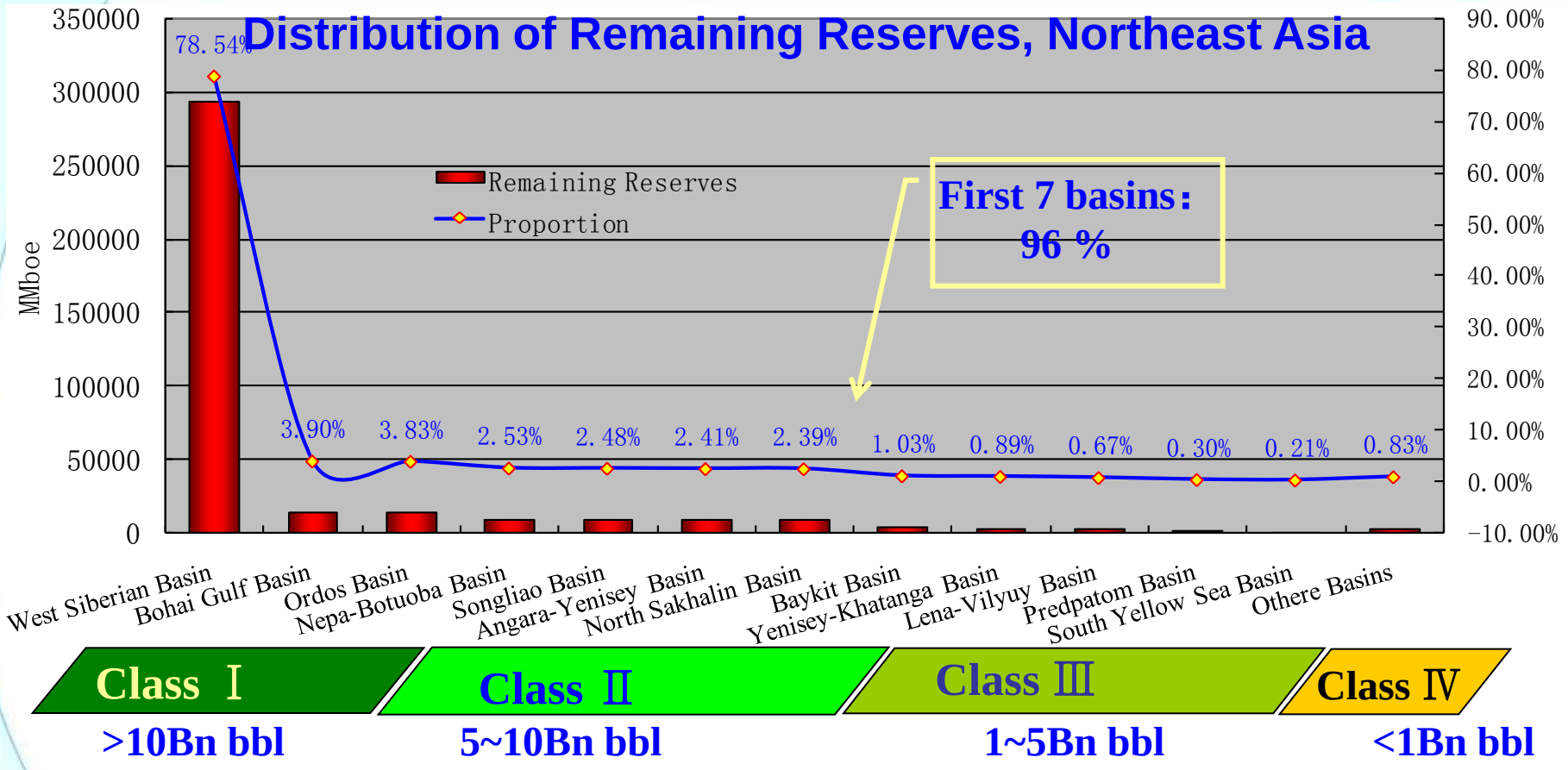
| Country/Area | Total Remaining PP Recoverable Reserves(MMboe) | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Total | Proportion | Oil Field | Gas Field | Oil and Gas Field | Onshore | Onshore/Offshore | Offshore |
| East Russia | 331977.4 | 88.81% | 258.22 | 9137.55 | 322581.6 | 295962 | 20442.37 | 15573 |
| North and Northeast China | 41227.17 | 11.03% | 140.18 | 6092.25 | 34994.74 | 32968.39 | 1744.04 | 6514.74 |
| Japan | 419.81 | 0.11% | 2.28 | 205.03 | 212.5 | 329.62 | 10.51 | 79.68 |
| South Korea | 95.02 | 0.03% | | 39.33 | 55.69 | | | 95.02 |
| Mongolia | 78.33 | 0.02% | | | 78.33 | 78.33 | | 0.5 |
| North Korea | 0.5 | 0.00% | 0.5 | | | | | |
| Sum | 373798.2 | | 401.18 | 15474.16 | 357922.86 | 329338.3 | 22196.92 | 22262.94 |

data from: IHS, 2011




- ✓ **Remaining reserves distribute in：East Russia, North and Northeast China**
- ✓ **Mainly distributed onshore**

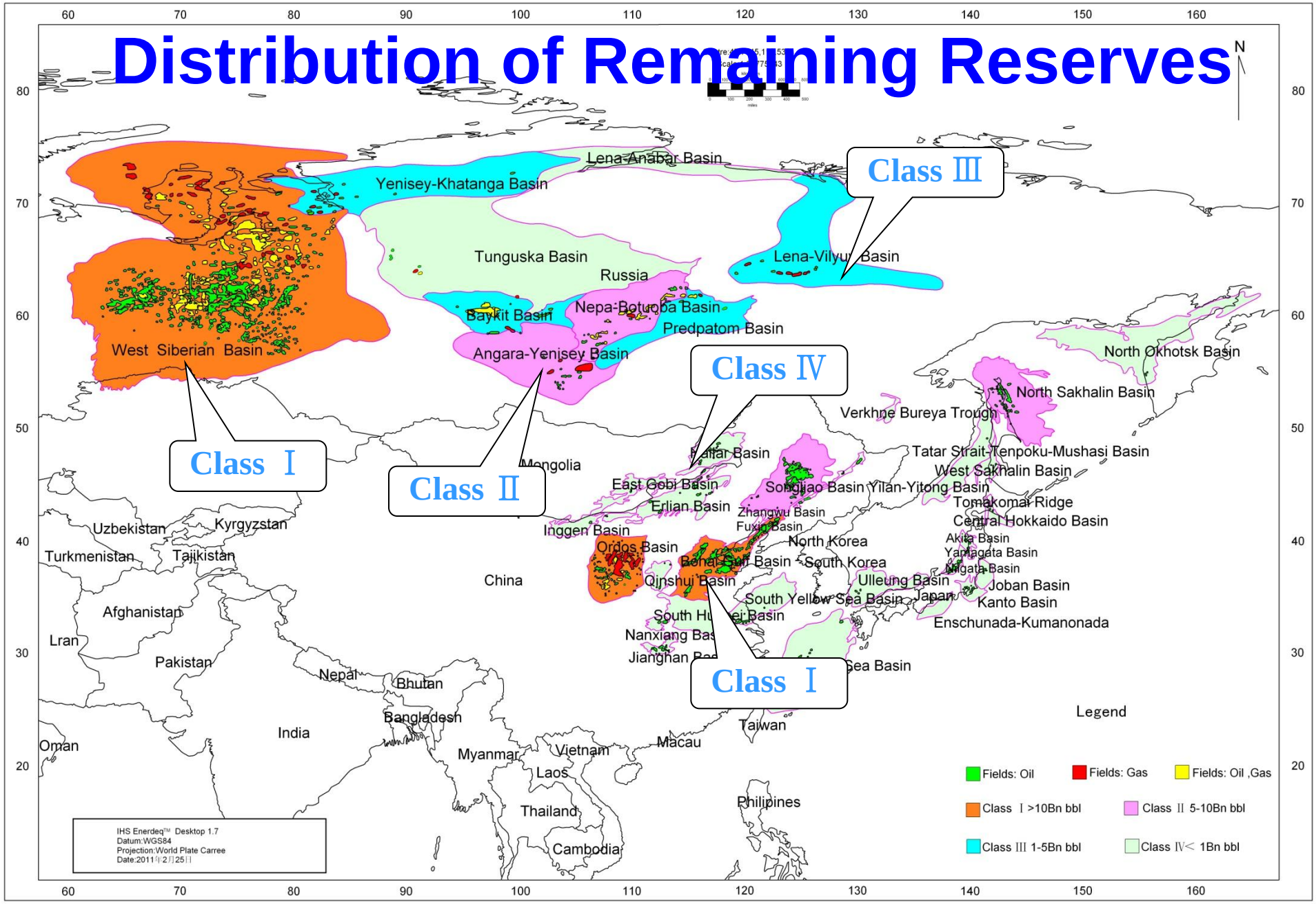
# Prospects of Exploration and Development



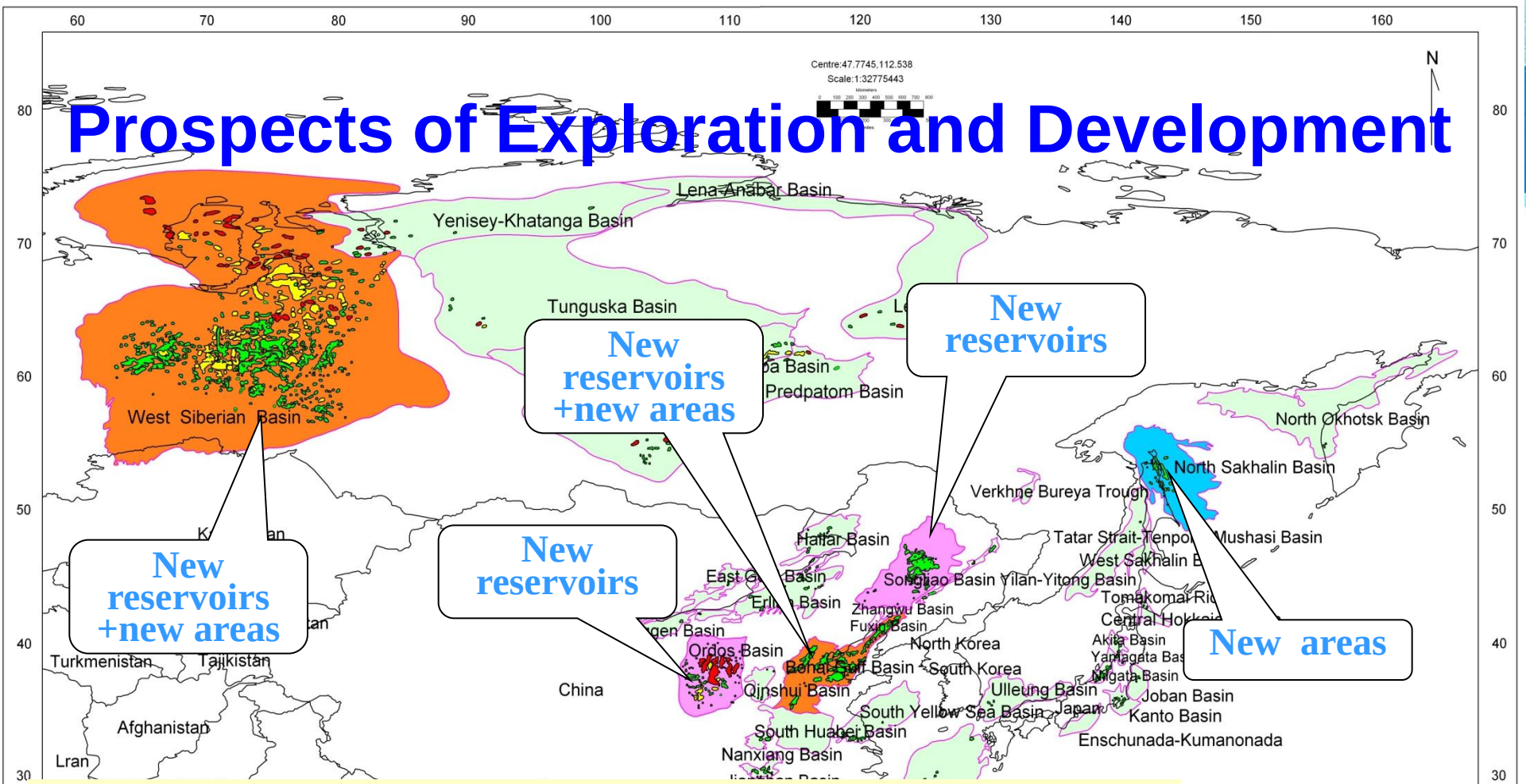

| Class Ⅰ | Class Ⅱ | Class Ⅲ | Class Ⅳ |
|---|---|---|---|
| >10Bn bbl | 5~10Bn bbl | 1~5Bn bbl | <1Bn bbl |

- Class Ⅰ: West Siberia, Bohai Gulf and Ordos Basin
- Class Ⅱ:Nepa-Botuoba, Angara-Yenisey, North Sakhalin and Songliao Basin

# Distribution of Remaining Reserves



# Prospects of Exploration and Development




- New (deep) Reservoirs： e.g. in Songliao and Ordos Basins
- New Reservoirs + New Areas： deep reservoirs prospects in maturity areas, new offshore areas, e.g. in West Siberia and Bohai Gulf Basins
- New Areas： deepwater area in North Sakhalin Basin

# Prospects of Exploration and Development

## Summary

- In East Mongolia where the maturity is much lower, there is great potential for exploration and development
- The resources within Arctic cycle（70°N） in East Russia is fairly rich, which is one of the favorable areas for replacement of exploration and developing. From USGS(2000), it is reported that there are 18.5Bnbbls oil equivalent undiscovered resources
- Most fields in East Russia are in primary development. And, if some increasing production measures could be taken, there will be much potential for production

# Conclusion

- Although there are fairly rich hydrocarbon resources in Northeast Asia, the distribution of resources is uneven and exploration maturity is low.
- There are many giant fields, which containing abundant reserves about 563.6Bnbbls oil equivalent, mainly distributed in East Russia and North and Northeast China.
- 227.4Bnbbls oil equivalent undiscovered resources are reported in Northeast Asia, mainly in West Siberia Basin, North Sakhalin Basin and Nepa-Botuoba Basin.

# Conclusion (continue)

- There is high success ratio（average：49.4%） of drilling in Northeast Asia, but during the last 10 years, drilling is not active and in the last 5 years, seismic acquisition are more active.
- There are some prospects in deep reservoirs in onshore mature exploration basins, also in deep reservoirs and new areas of shallow water in Bohai Gulf basin, deepwater in North Sakhalin basin and offshore areas in West Siberia basin.

# Thank You For Attention!