

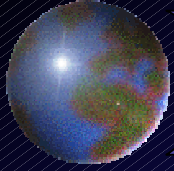
Chinese Hydrocarbon Resources / Reserves Classification System

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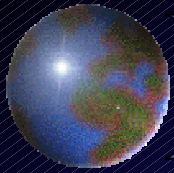


Chinese Hydrocarbon Resources / Reserves Classification System



- **Background**
- **Standards Setting**
- **Basic Features of Current System**
- **New Features of Newly Amended System**



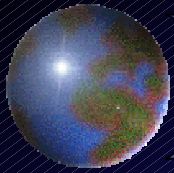


Background



- China was the first country to discover and use gas, but China only began developing a modern oil and gas industry in the 1950s.
- In 1952, the Ministry of Geology and Mineral Resources was set up. The first oil geologic reserves (OOIP) estimation was made in *Yumen* area, *Gansu* Province, with the help of FSU experts(1953).
- Since the 1970s, China has explored and developed hundreds of field in 26 basins. The oil and gas reserves were estimated under the regulations of the government until 1984.
- In 1998, the Ministry of Land and Resources was set up. The mineral resources/reserves management is one of its main responsibilities.





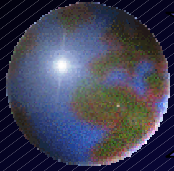
Background



- Three Major Corporations:
—— PetroChina, Sinopec, CNOOC



- Reserves were estimated by local experts and audited by government appointed evaluators.

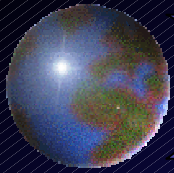


Background



- The hydrocarbon resources of China were estimated about 100 billion tonnes of oil in place and about 50 trillion (10^{12}) m^3 of gas in place.
- As of the end 2002, the measured hydrocarbon in place in Chinese current classification and estimation standard were estimated 22.7 billion tonnes of oil and 4.5 trillion m^3 of gas, the remaining reserves were 2.4 billion tonnes of oil and 2.0 trillion m^3 of gas.

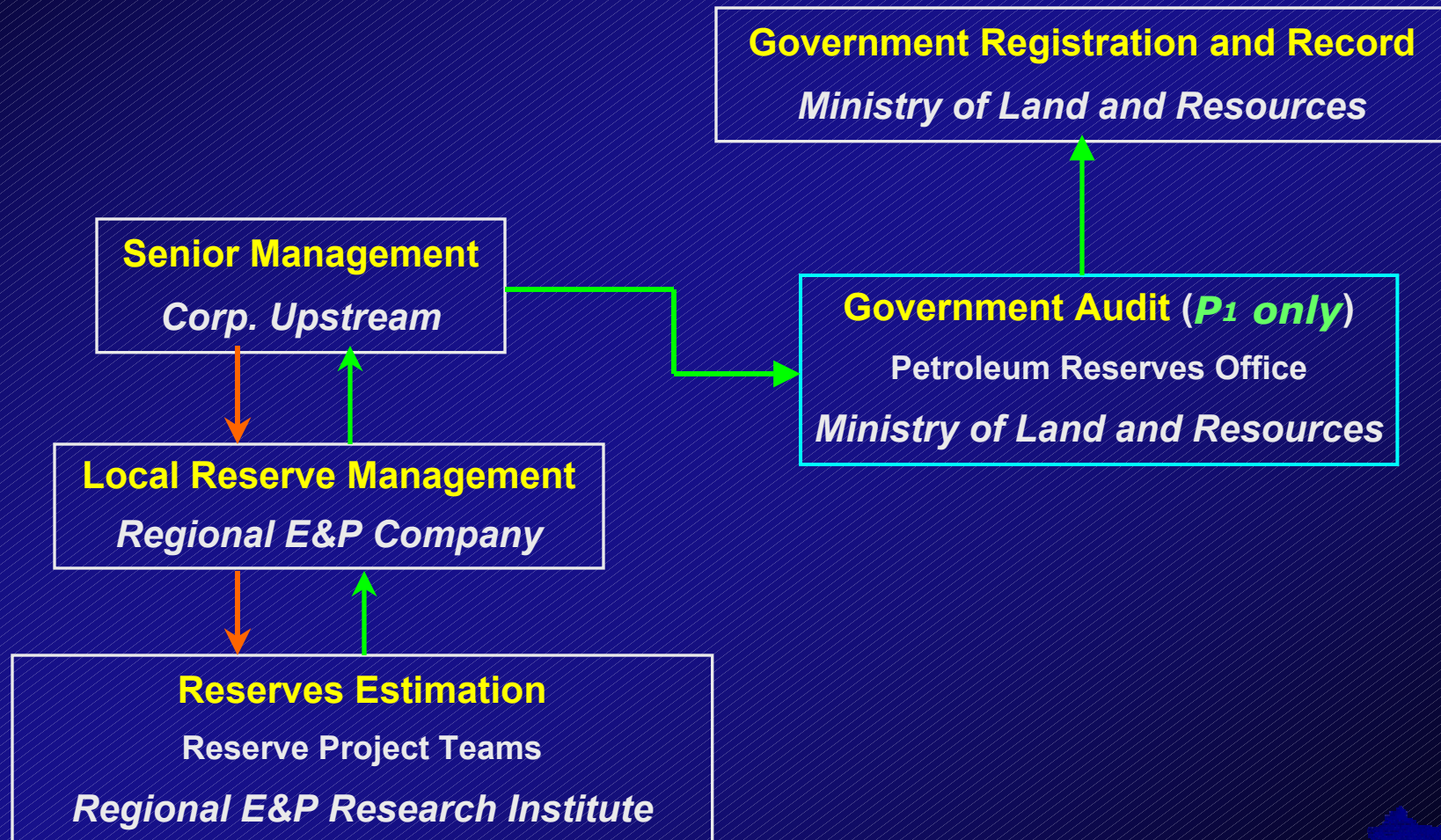


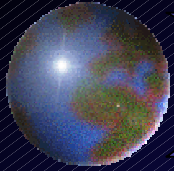


Background



Reserves Activity Organization



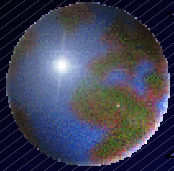


Standard Setting



- In 1977, the Ministry of Petroleum issued a geologic reserves calculation guideline.
- In 1982, the Research Institute of Petroleum E&D set up criteria for oil and gas reserves estimation.
- In 1984, China National Mineral Reserves Committee was formed. The study and setting of mandatory criteria for oil and gas reserves estimation was begun.



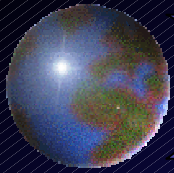


Standard Setting



- In 1988, China National Standard Bureau adopted and issued the Committee's criteria.
- Since 2000, the Ministry of Land and Resource has been working on the amendment of the criteria taking into consideration of SPE/UNFC definitions.
- The new criteria will be approved and issued by the National Standard Committee around the end of this year.

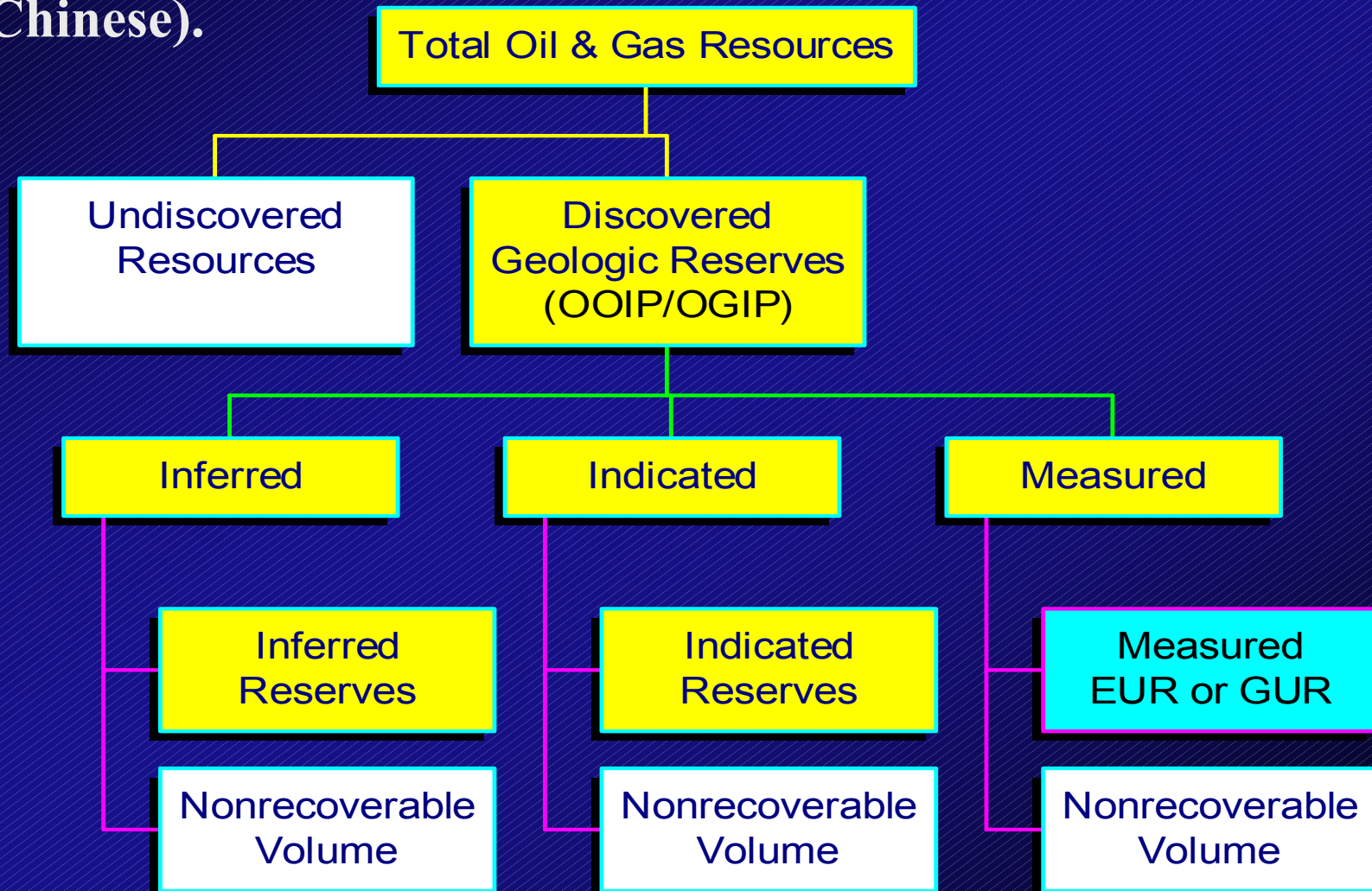


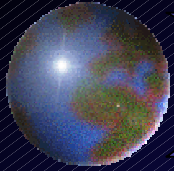


Basic Features of Current System



- The current system is also a three-class system but mainly for the classification of **OOIP/OGIP** (*Geologic reserves* in Chinese).





Basic Features of Current System



- Technically, the assignment of different classes of geologic reserves is based on the phases of exploration and development or the maturity of E&D and the knowledge of the specific reservoirs or blocks (mainly on geology).

Main Phases

Early exploration and discovery

Exploration well test with industrial flows

End of exploration

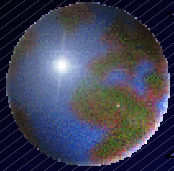
Resource Classes

Inferred

Indicated

Measured





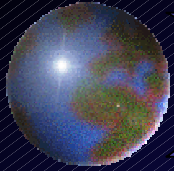
Basic Features of Current System



- Criteria to determine industrial flows in a well (the lowest limits to calculate reserves) :

Depth of Reservoir (m)	Well Test Production	
	Oil (tonne/d)	Gas (10 ⁴ m ³ /d)
≤ 500	0.3	0.05
□ 500 □ 1000	0.5	0.1
□ 1000 □ 2000	1.0	0.3
□ 2000 □ 3000	3.0	0.5
□ 3000 □ 4000	5.0	1.0
□ 4000	10.0	2.0



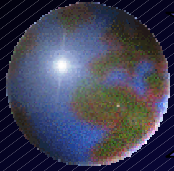


Basic Features of Current System



- Different classes of geologic reserves require different amounts of data acquired as well, from seismic, drilling, logging, and production tests, to sampling analysis, to reflect the phases of E&D and the certainty of geologic understanding to the specific reservoir(s).



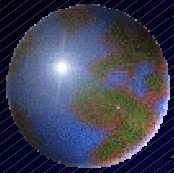


Basic Features of Current System



- The classes of recoverable reserves are the same classes as corresponding geologic reserves.
- In fact, the booking of recoverable reserves of a reservoir is the estimated ultimate recoveries up to the product of an estimated OOIP (or OGIP) times an estimated recovery efficiency during the appraisal and development phases, even at the stage of production decline in Chinese standard.
- For the estimate of oil reserves, Chinese standards typically take into account water drive factors whenever water injection will be performed, since most of the oil reservoirs need and are produced with secondary drive energy.



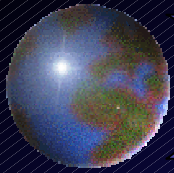


Basic Features of Current System



- **Measured geologic reserves** are estimated after completion or near completion of evaluation drilling. Under the present technical and economic conditions, they are reliable resources for development and social economic profit. Measured geologic reserves are the basis to make a development plan and to determine investment in construction of field development and to study production performance.
- In estimation, modern geophysical exploration technology and reservoir boundary detecting approach should be used as much as possible to identify reservoir type, structure feature, reservoir thickness, lithology, petrophysics, water saturation and/or fluid boundaries.





Basic Features of Current System

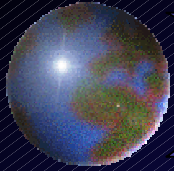


Resources may be classified as **Measured geologic reserves** as follows:

(a) All petrophysical data have been acquired in the discovery well(s) with industrial flow(s), the resources/reserves can be calculated in a reasonable area surrounding the well(s);

(b) Basic necessary petrophysical data have been taken in a small fault block or lithologic trap which area is less than **1 km²** ;





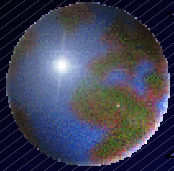
Basic Features of Current System



- Resources may be classified as **Measured geologic reserves** as follows (*cont.*):

(c) For simple types of medium and small size reservoirs, detail seismic survey has been done and structure conformation is identified, fluid contacts and hydrocarbon bearing boundaries have been determined or estimated, all the petrophysical data have been taken, though only a few appraisal wells showed industrial flows;





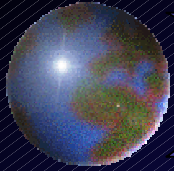
Basic Features of Current System



- Resources may be classified as **Measured geologic reserves** as follows (*cont.*):

(d) For large hydrocarbon bearing traps, though the boundary hasn't been identified, appraisal wells control optimal locations of the reservoirs and other parameters have been taken, and the Measured area is constrained by external tangent lines of radius of oil/gas deliverabilities.



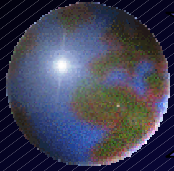


Basic Features of Current System



- In the Chinese definition of reserves, economic viability is not emphasized or lacks clarification, except the criteria of industrial flows (as above).
- On geologic grounds, the geologic interpretation in the E&D phases convey simplified reservoir models, especially in the estimation of fluid contacts for complex multi-layer systems with continental sedimentary characteristics. So the extent of proved geology is subject to uncertainties or highly graded in some reservoirs.



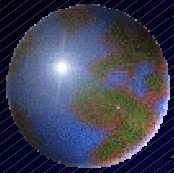


Basic Features of Current System



- On feasibility, the approvals of applying to install or operate technically applicable projects (water injection for instance) in the fields outside natural reserve areas in China are a matter of course.
- So the consideration on field project grounds in the definitions of reserves is much weaker.
- To some extent, the E&D phases reflect the feasibility of projects but in a different way as to technical data acquisition systematically.





Basic Features of Current System



• Sketch comparison

Chinese Measured Recoverable Reserves

Production	SPE Proved	SPE Probable	P_4
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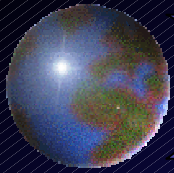
Chinese Indicated Recoverable Reserves

SPE Proved	SPE Probable	SPE Possible	SPE Contingent Resources(P_{4+5})
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Chinese Inferred Recoverable Reserves

SPE Probable	SPE Possible	SPE Contingent Resources(P_6)
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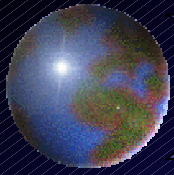


Basic Features of Current System



• Sketch comparison

<i>Chinese (1988-2003)</i>	<i>UNFC Codes</i>	<i>Key Number of F axis</i>
Measured Geologic Reserves	I1	
Indicated Geologic Reserves	I2	
Inferred Geologic Reserves	I3	
Prospective Resources in Place	I4	
Measured Recoverable Reserves		10, 20
- Developed	111, 211	11
- Undeveloped	112, 121, 122, 221, 222	12, 13, 21, 22, 23
- Basic Measured	112, 122, 222	12, 13, 21, 22, 23, 24
Controlled Recoverable Reserves	122, 222, 322	23, 22
Inferred Recoverable Reserves	223, 333	23, 24, 31
Prospective Recoverable Resources	234, 334	30, 40

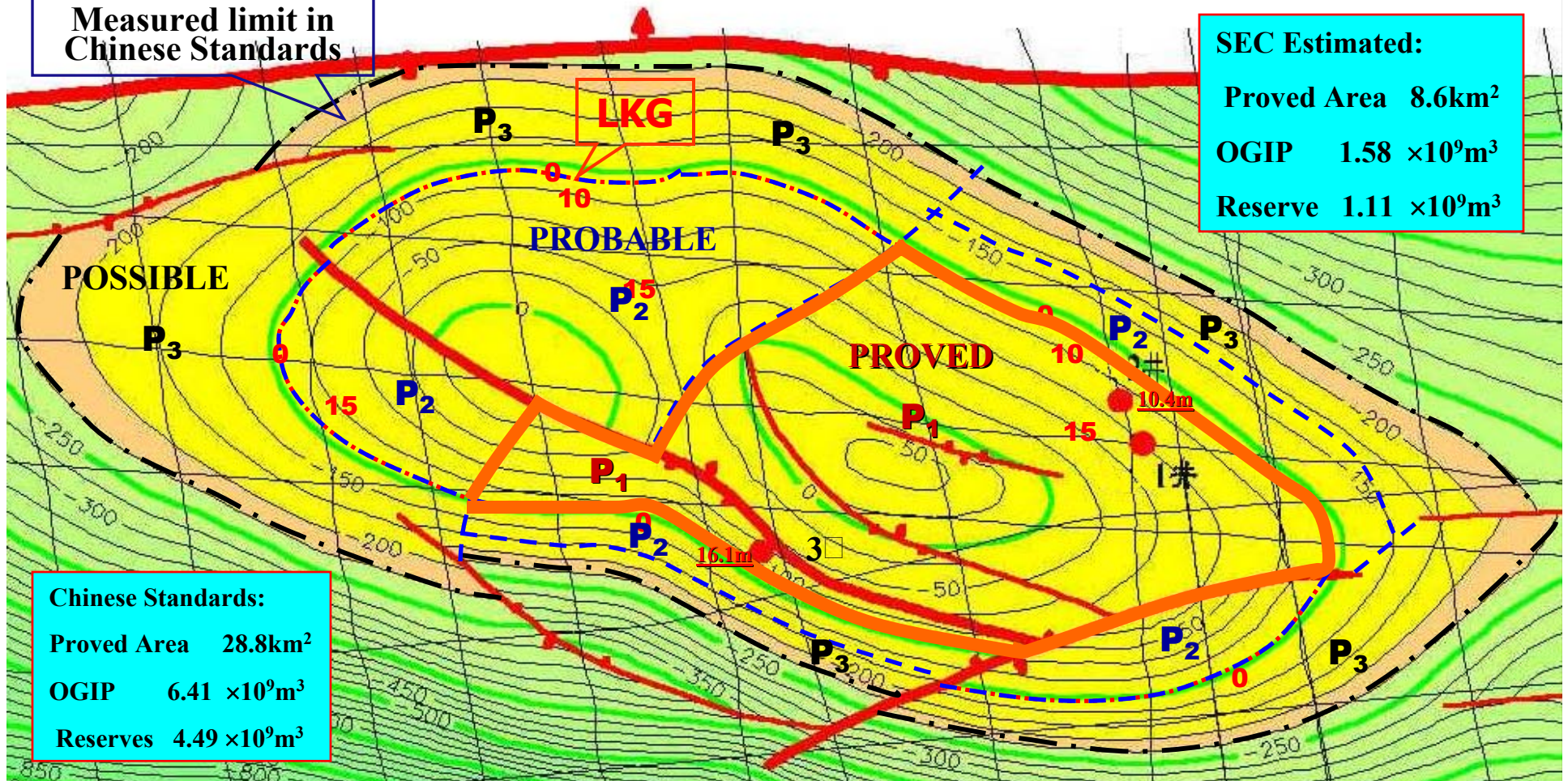


Basic Features of Current System



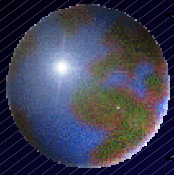
Measured limit in Chinese Standards

SEC Estimated:
Proved Area 8.6km²
OGIP 1.58 × 10⁹m³
Reserve 1.11 × 10⁹m³

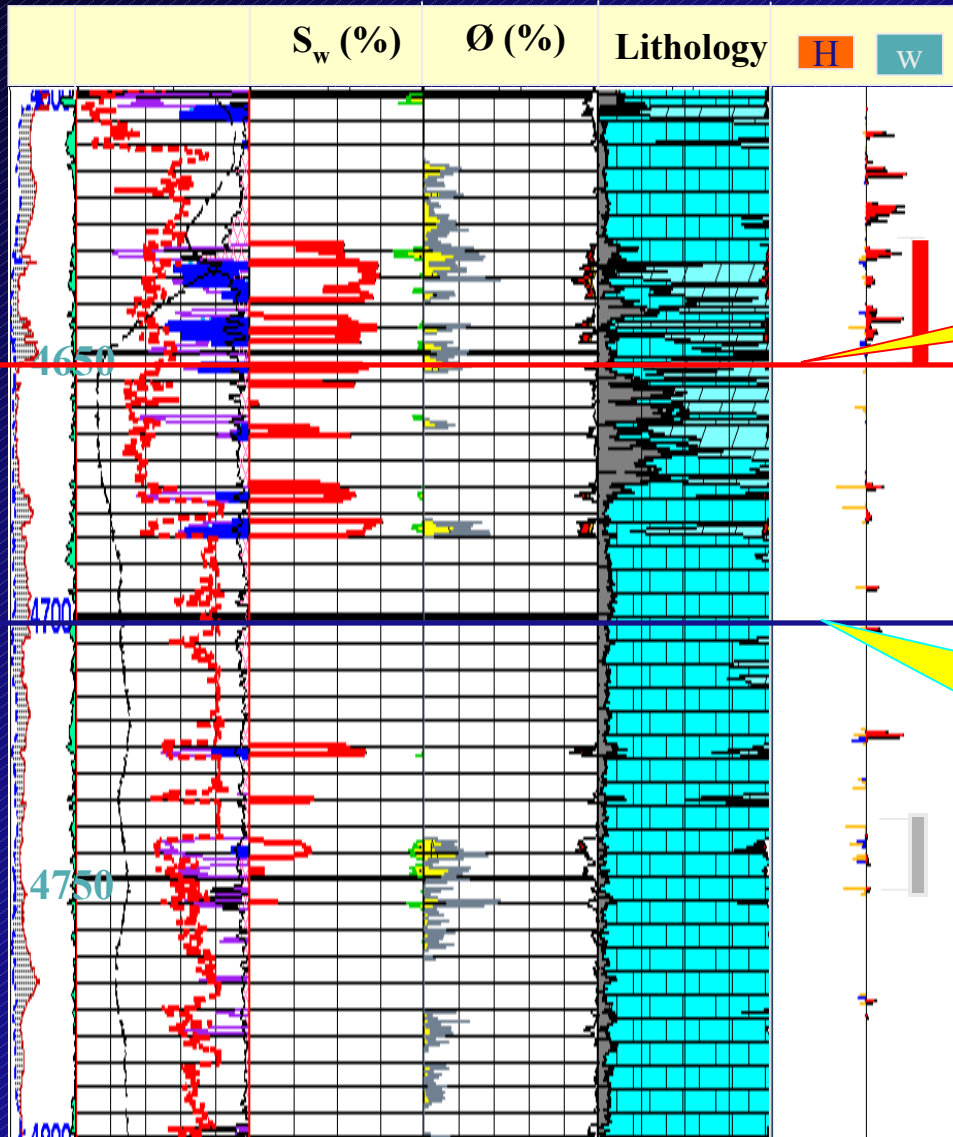


Chinese Standards:
Proved Area 28.8km²
OGIP 6.41 × 10⁹m³
Reserves 4.49 × 10⁹m³





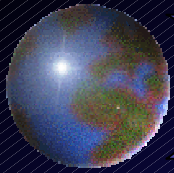
Basic Features of Current System



SPE Proved limit — LKG

Chinese estimated Measured limit — middle point of LKG and the top of perforated dry interval.

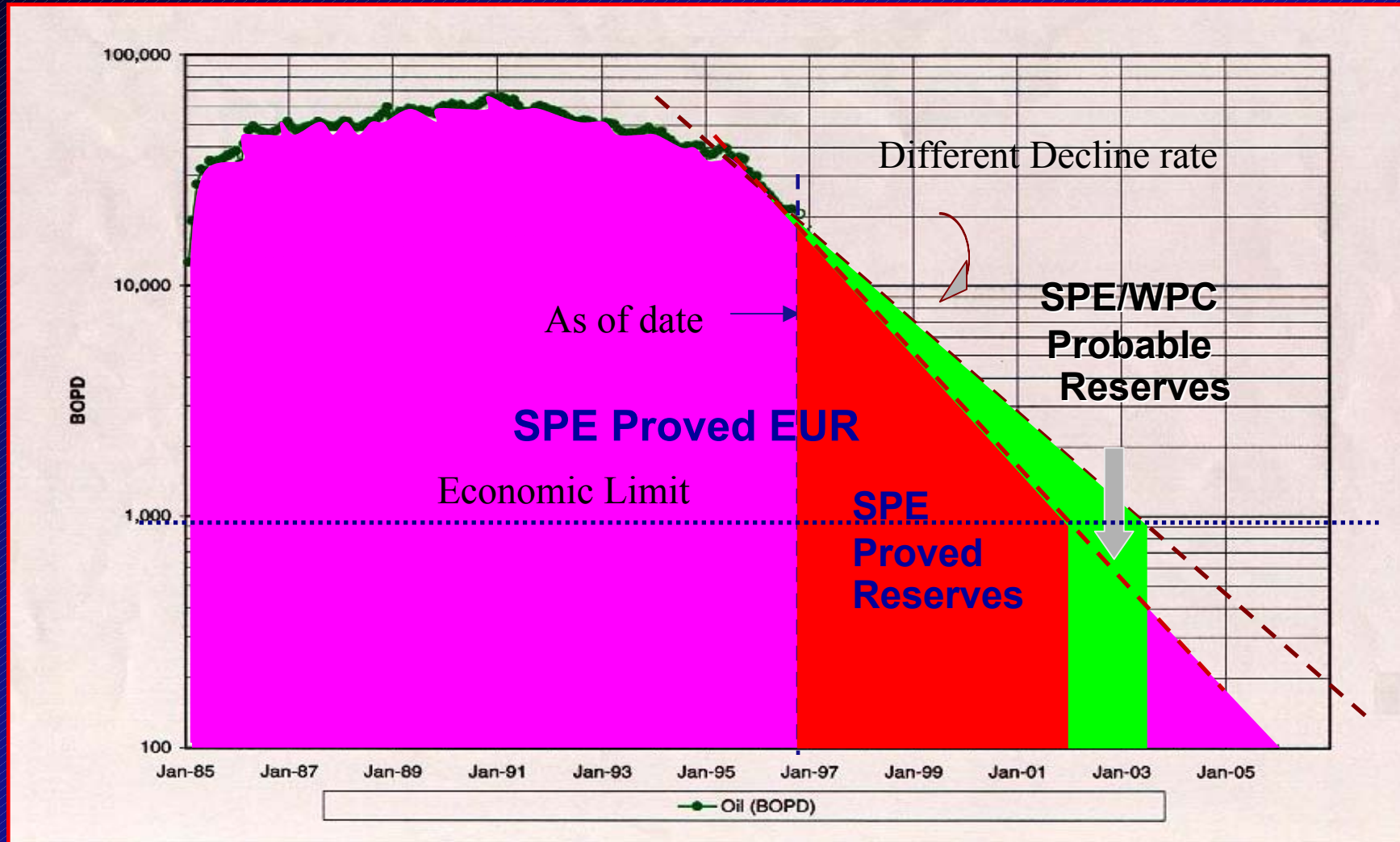




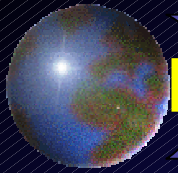
Basic Features of Current System



Probable reserves in the production decline period



There are no probable reserves at all in the decline phase in Chinese standards.

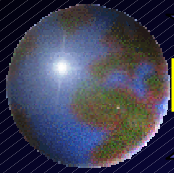


New Features of Newly Amended System



- **To consist with SPE/UNFC classification, the Ministry of Land and Resources has revised the 1988 criteria.**
- **The new system**
 - **keeps the basic features of current system in: phases and maturity of E&D, industrial flows and technical data acquisition requirement;**
 - **combines the SPE definitions of Proved reserves and parts of those considerations of Probable and Possible reserves of SPE;**
 - **adopts international comparable terms of reserves (3P system) for the use of international cooperation, evaluation and study;**





New Features of Newly Amended System



• The new system (*cont.*)

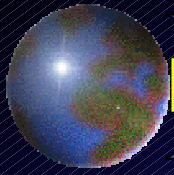
—— Corresponds technically proved initial reserves exactly to Proved Estimated Ultimate Recovery;

—— Narrows down the connotation of proved reserves on geologic grounds, especially for the meaning of proved limits (LKH/LKO/LKG);

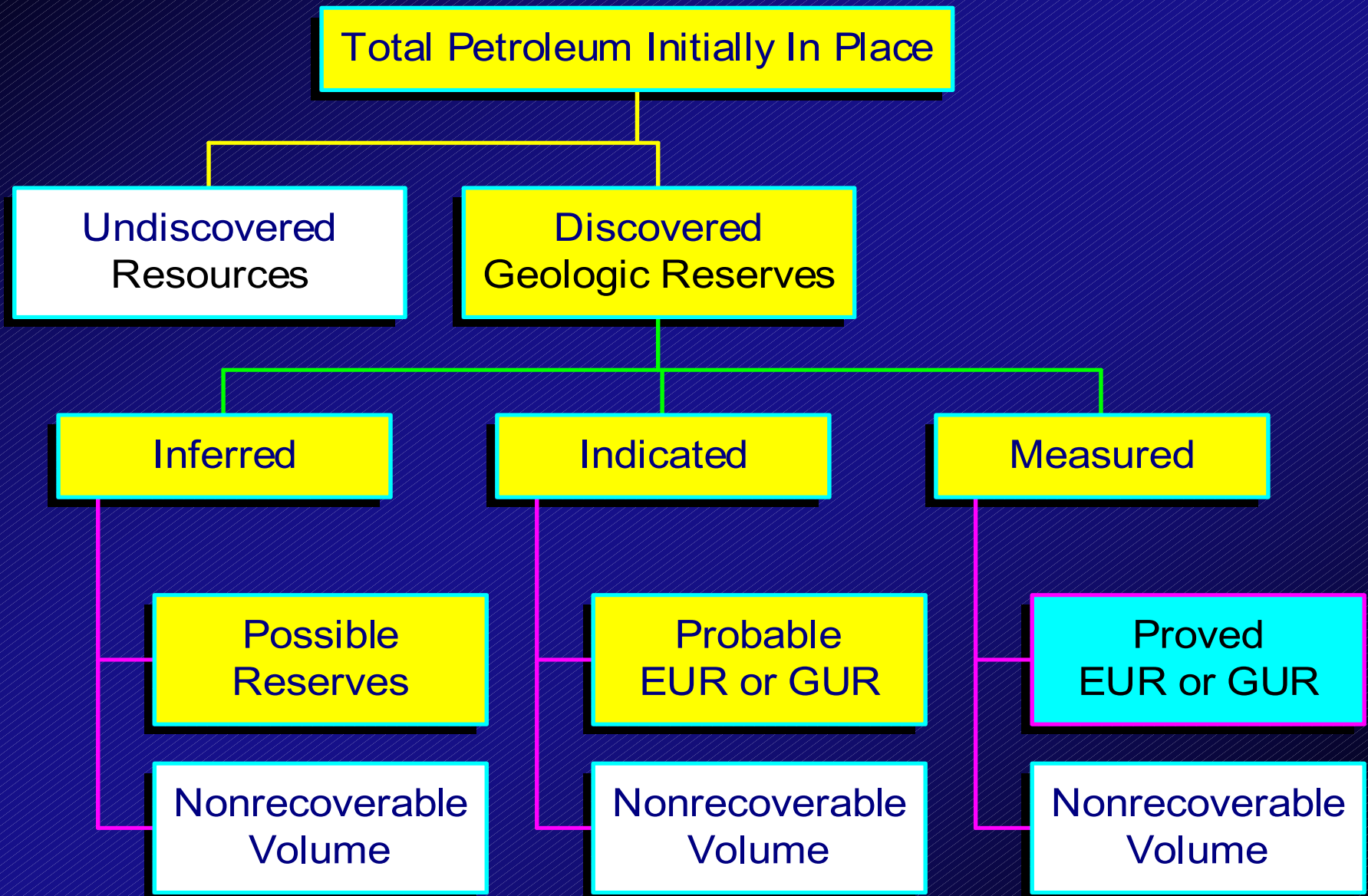
—— Corresponds Proved Remaining Reserves exactly to SPE Proved Reserves;

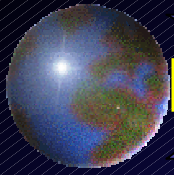
—— Keeps the economically sub-marginal reserves but separately classified as sub-economic reserves (as part of technical reserves).



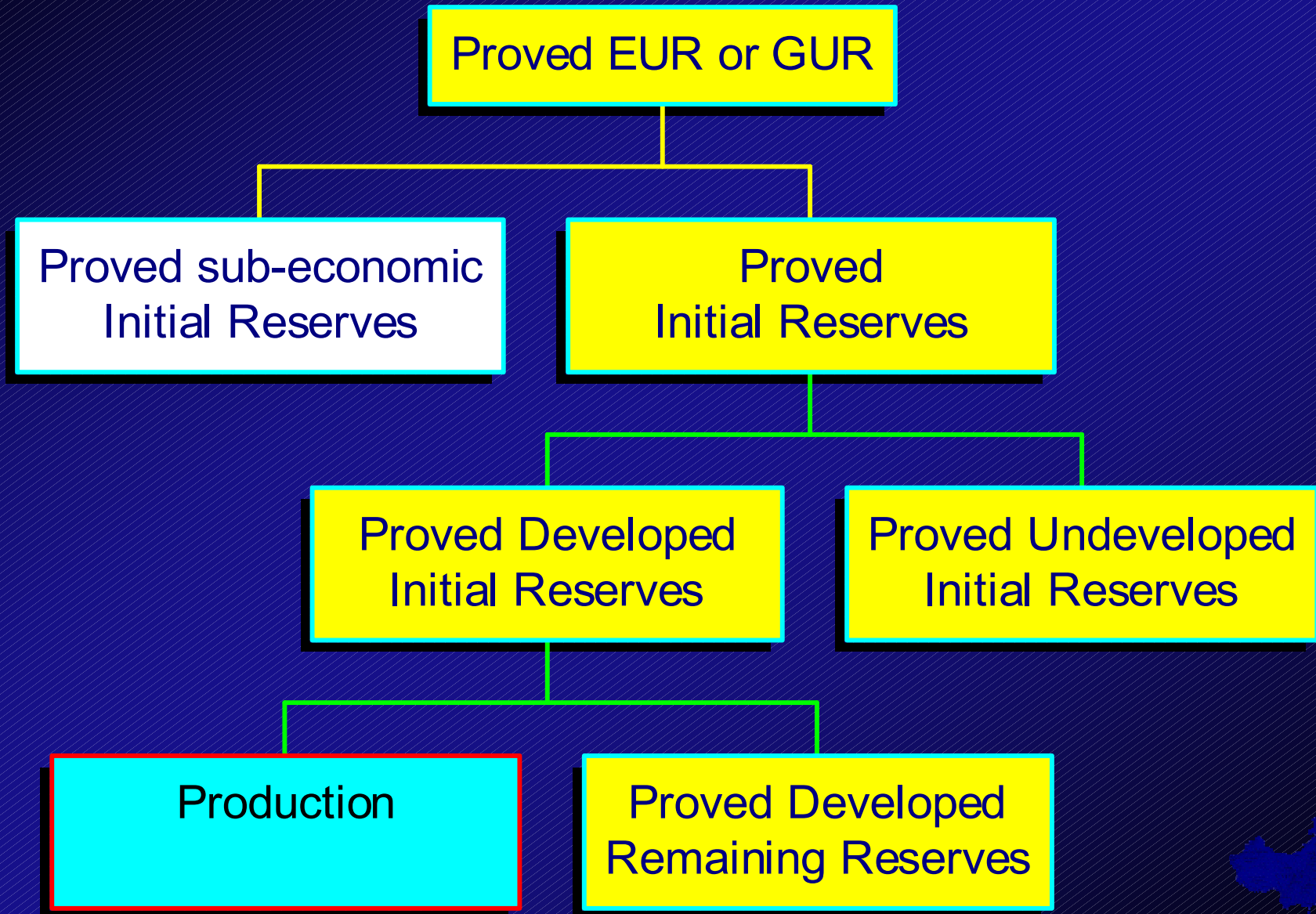


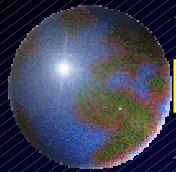
New Features of Newly Amended System





New Features of Newly Amended System





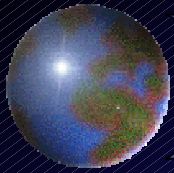
New Features of Newly Amended System



Comparison to UNFC

Chinese (new system)	UNFC Codes
Measured Petroleum Initially In Place	I1
Indicated Petroleum Initially In Place	I2
Inferred Petroleum Initially In Place	I3
Petroleum Initially In Place in Prospects	I4
Proved Estimated Ultimate Recovery	111, 121, 211
Proved Initial Reserves	111, 121
- Proved Developed Initial Reserves	111
- Proved Developed Remaining Reserves	111
- Proved Undeveloped Initial Reserves	121, 111
Proved sub-economic Initial Reserves	211
Probable Reserves	122, 112
Probable sub-economic Initial Reserves	222
Possible Reserves	223





Thanks!

