



IS THERE A FUTURE FOR PROFESSIONALS IN THE PETROLEUM INDUSTRY?

TODAY'S STUDENTS,
TOMORROW'S PROFESSIONALS....

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Geology and Geophysics,
University of Adelaide,
Australia

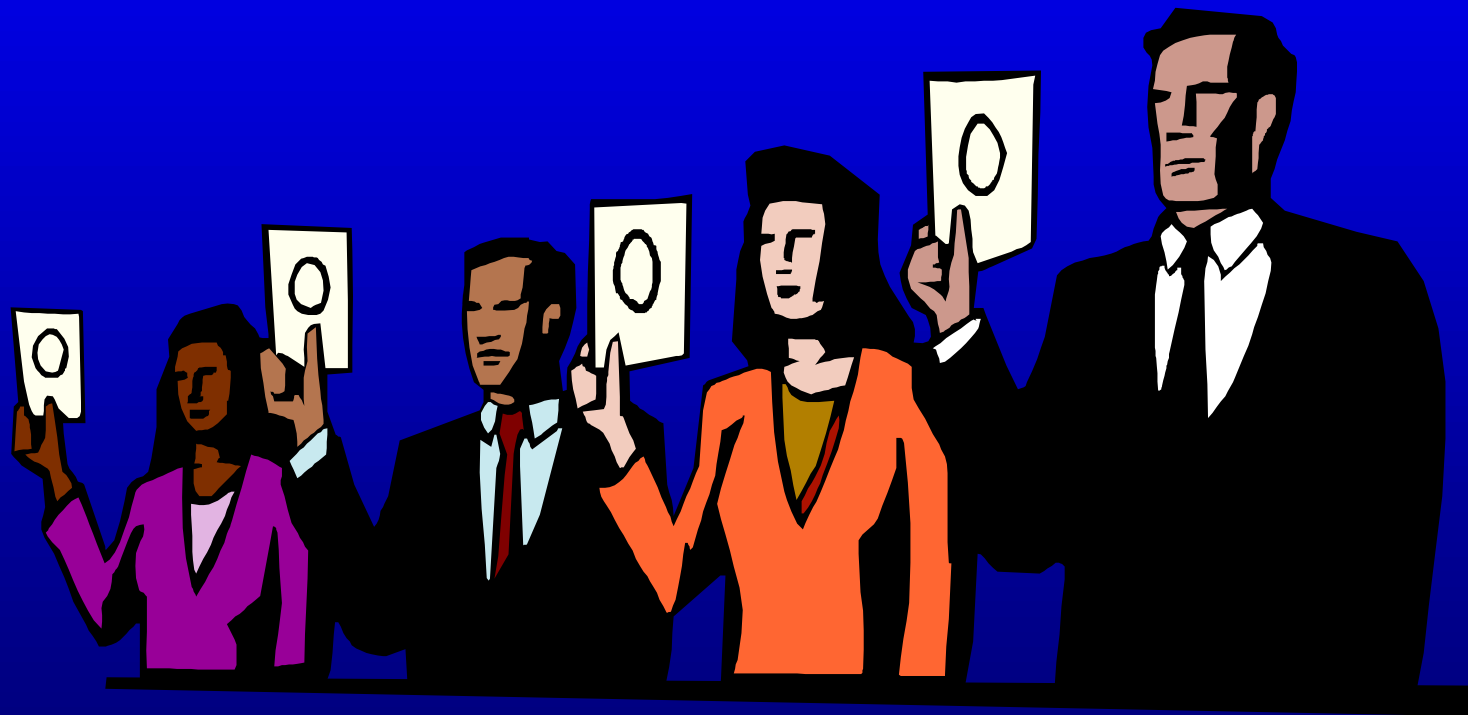


**IS THERE A FUTURE FOR
PROFESSIONALS
IN THE PETROLEUM INDUSTRY?**

WHO CARES?

- Industry
- Universities
- Government
- Students

AUDIENCE PARTICIPATION



AUSTRALIAN GEOSCIENCE HONOURS STUDENTS

Why Study Geology / Geophysics ?

STABLE CAREER

LIKE ROCKS

LIKE BEING OUTDOORS

GOOD PAY

HIGH TECH CAREER

Started University Intending to Study Geoscience

YES

NO

AUSTRALIAN GEOSCIENCE HONOURS STUDENTS

Started University

Intending to Study Geoscience

90%

75%

50%

25%

10%

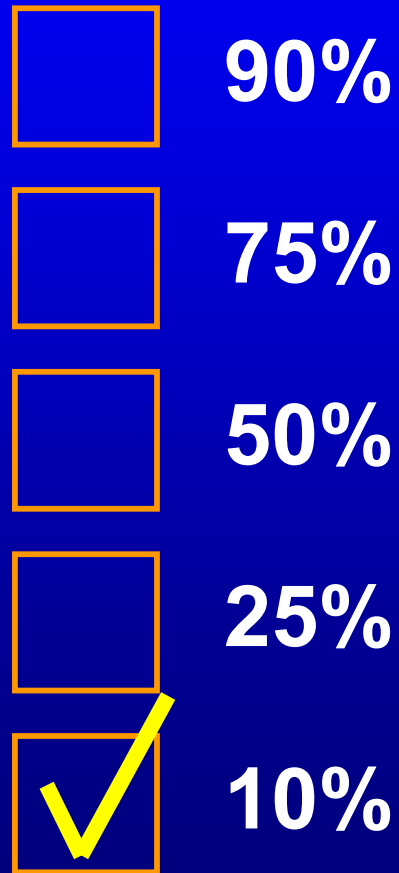
Started University With Some Geology Background (High School)

YES

NO

AUSTRALIAN GEOSCIENCE HONOURS STUDENTS

Started University With Some Geology
Background (High School)

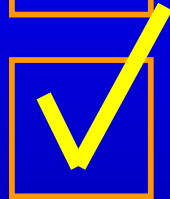


AUSTRALIAN GEOSCIENCE 1st YEAR STUDENTS

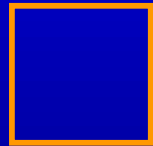
Why Leave Geology / Geophysics ?



UNSTABLE CAREER FUTURE



LOW TECH CAREER



DON'T LIKE BEING OUTDOORS



BETTER PAY IN OTHER FIELDS



ENVIRONMENTAL CONCERNS

29 Major, Large Independent, Small Oil Co. Managers

Most Desirable Degree for Employment

BSc

MSc

PhD

THE GEOSCIENCE GRADUATE'S OPTIONS

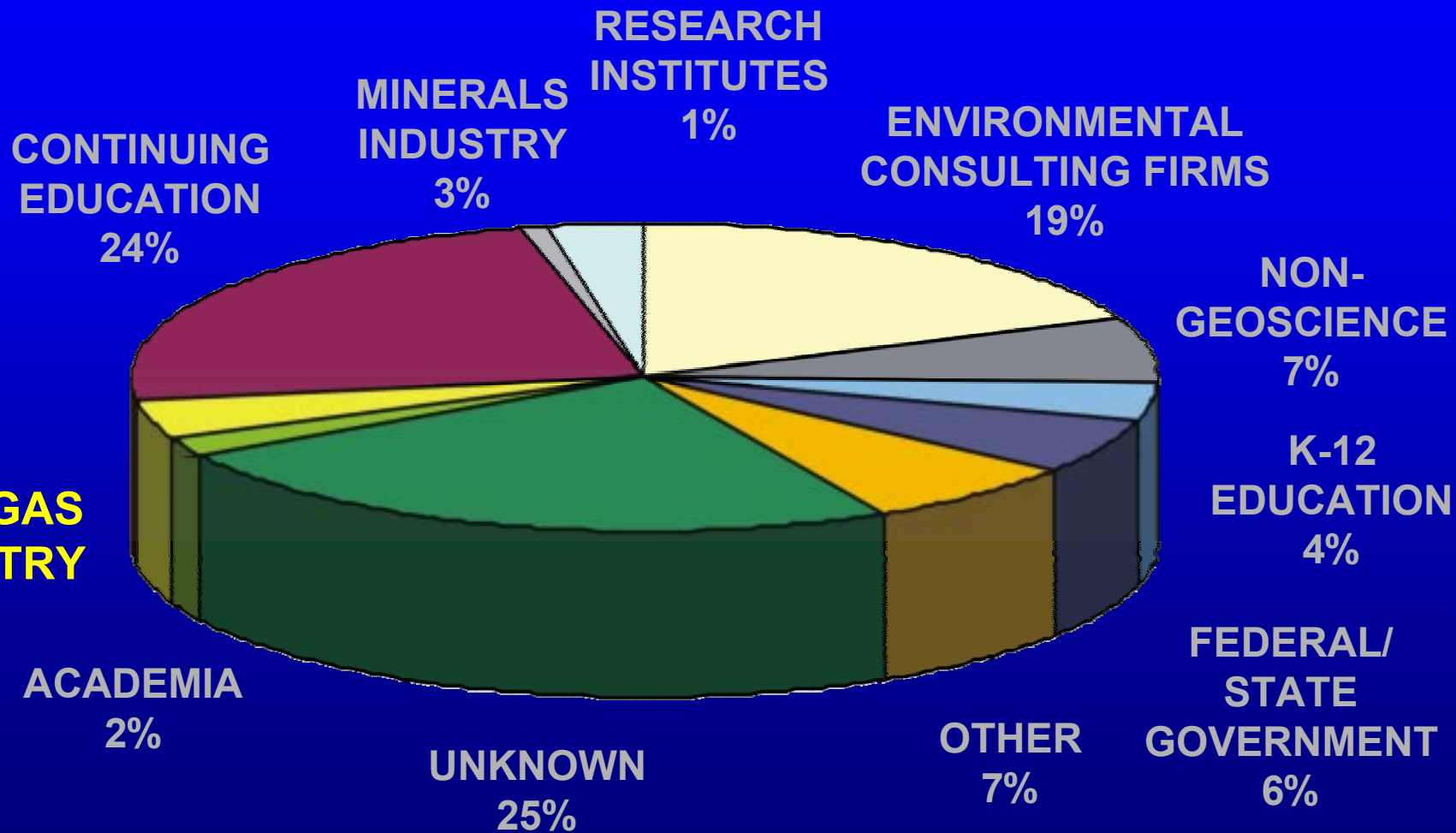
Minerals

Oil & Gas

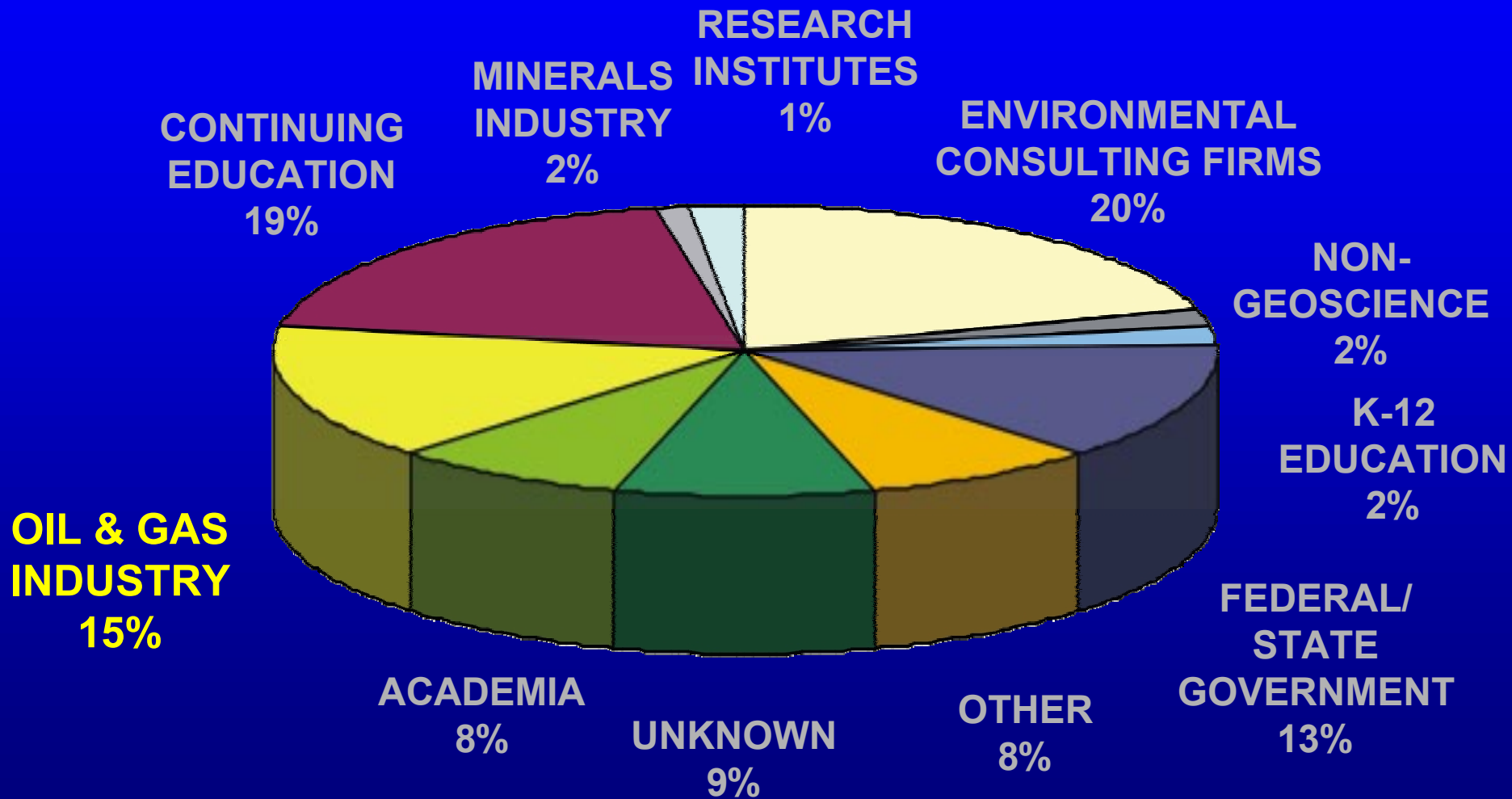
Other



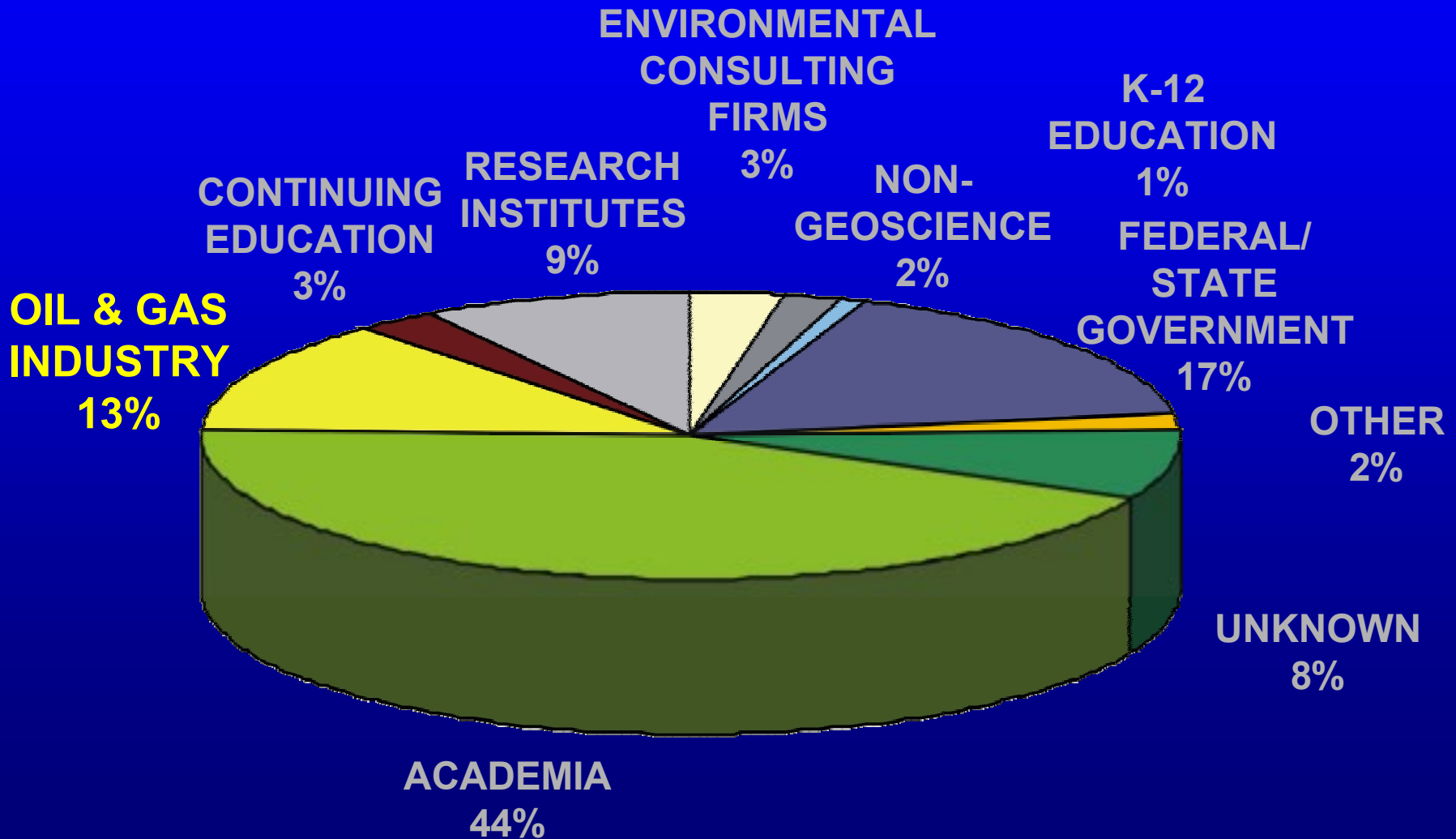
EMPLOYMENT TRENDS OF RECENT UNDERGRADUATES



EMPLOYMENT TRENDS OF RECENT MASTER'S RECIPIENTS



EMPLOYMENT TRENDS OF RECENT Ph.D. RECIPIENTS



SURVEY OF SKILLS NEEDED BY OIL COMPANIES

A comprehensive survey was distributed to Exploration Managers or Senior Technical Managers of 45 leading oil and gas companies worldwide. 29 (7 major, 12 large independent, and 10 small oil companies) responded.

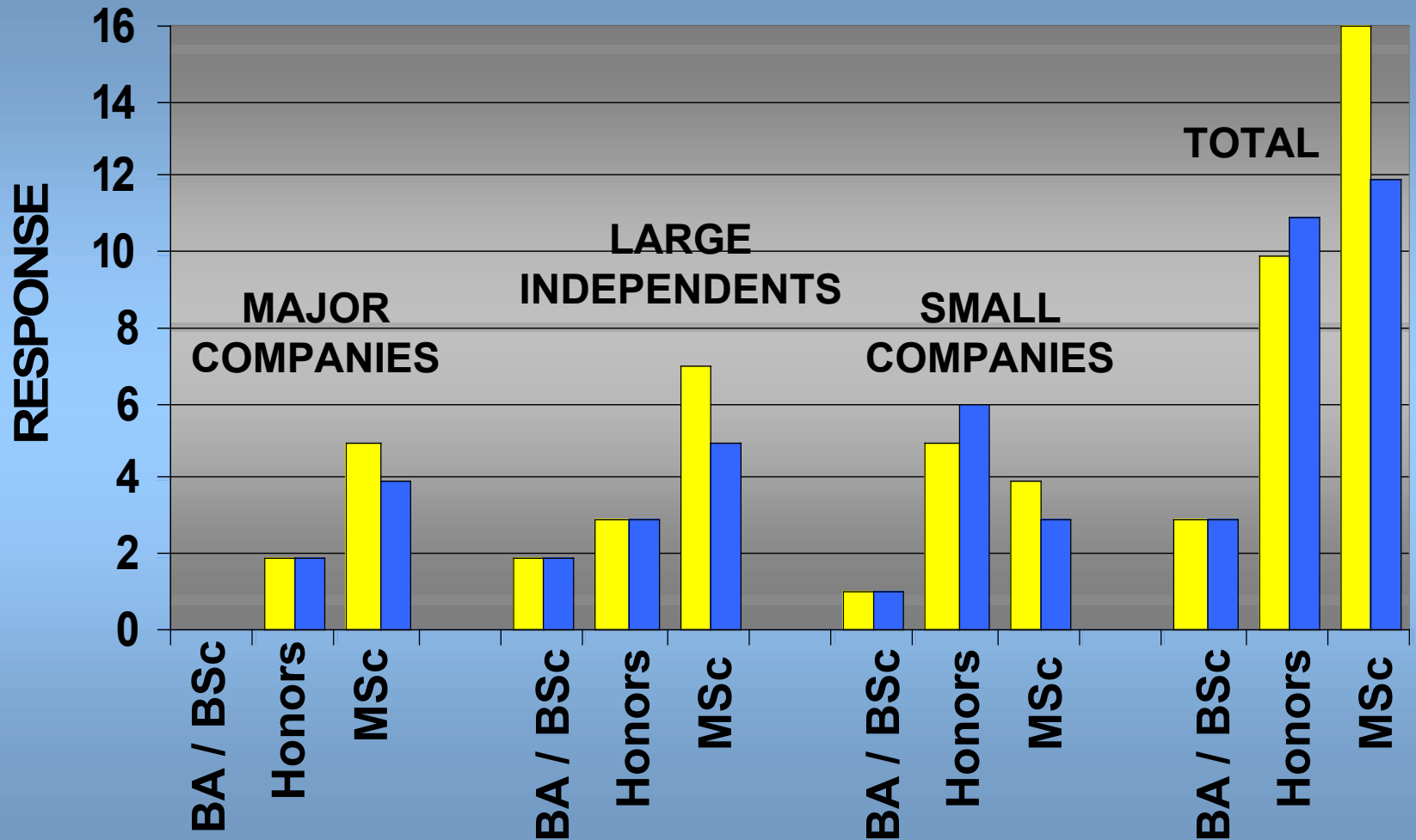
The survey comprised 120 preferential ranking exercises asking companies to assess relative importance of numerous 'sub-disciplines' of geology, geophysics, math, computer science as well as non-technical skills.

SURVEY OF SKILLS NEEDED BY OIL COMPANIES

The objectives of the study were to determine:

- The minimum geoscience degree qualification now required and likely to be required by oil companies**
- The critical geological / geophysical skills needed in the petroleum industry**
- The level of computer competency expected**
- Other components of a geoscience education (eg math, chemistry, business skills)**
- The significance and value of non-technical or soft skills in the industry**

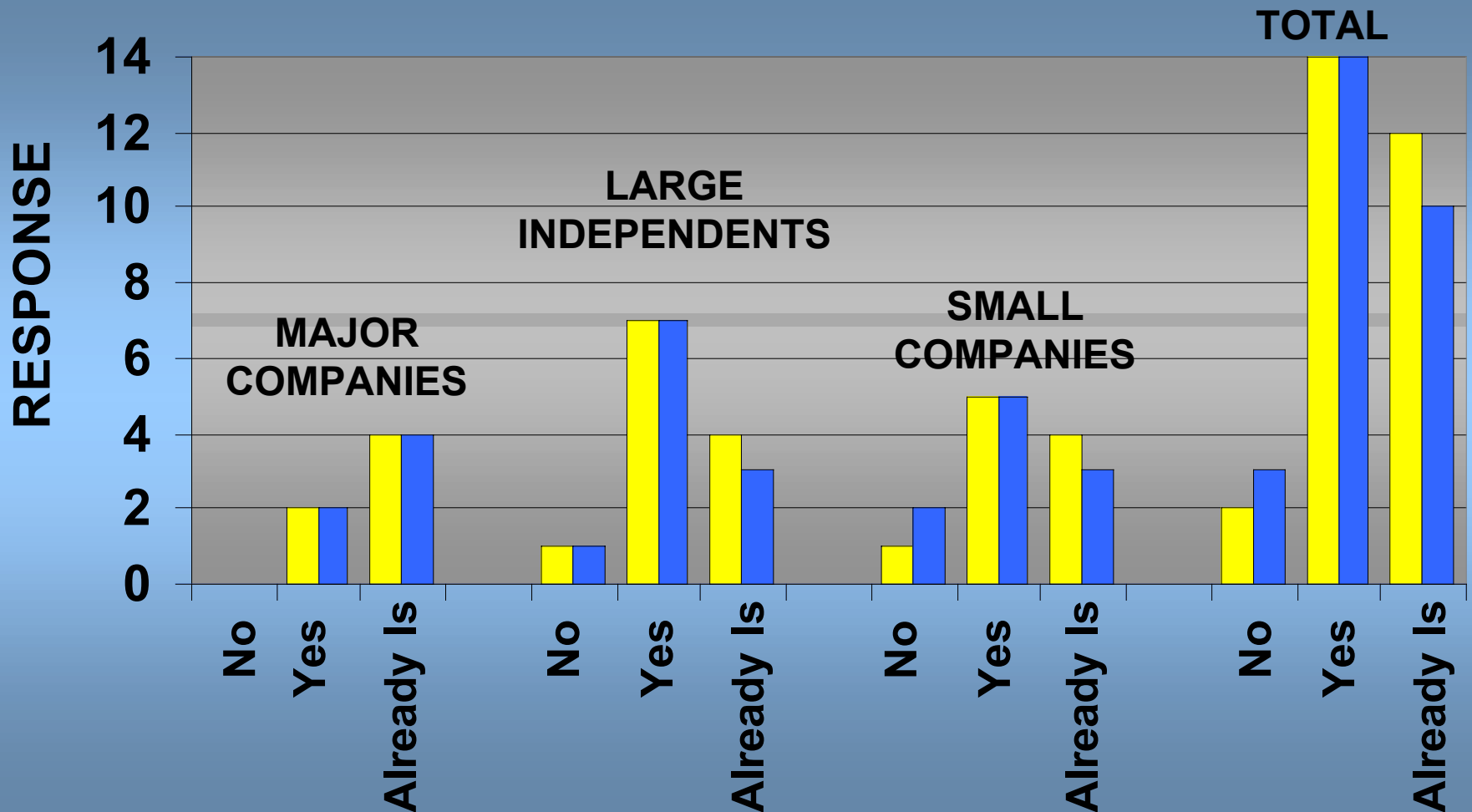
PRESENT DEGREE REQUIREMENT FOR EMPLOYMENT



GEOLOGISTS
 GEOPHYSICISTS

From Heath (2000)

WILL THE FUTURE MINIMUM QUALIFICATION BE A MASTERS DEGREE ?



GEOLOGISTS
 GEOPHYSICISTS

From Heath (2000)

GEOSCIENCE SKILLS NEEDED BY OIL COMPANIES

SKILLS (TOP SCORE = 100)	IMPORTANCE		
	MAJOR COMPANIES	LARGE INDEPENDENTS	SMALL COMPANIES
SEDIMENTOLOGY	89	79	75
GEOPHYSICAL INTERPRETATION	86	71	85
SUBSURFACE MAPPING	85	81	90
STRATIGRAPHY	82	81	78
BASIN ANALYSIS/HYDROCARBON SYSTEMS	82	75	63
SEQUENCE STRATIGRAPHY	82	71	70
PETROLEUM GEOLOGY	79	85	83
RESERVOIR GEOLOGY	75	71	75
INTRODUCTORY GEOPHYSICS	71	75	68
REGIONAL GEOLOGY	71	75	63

- MAJOR COMPANIES
- LARGE INDEPENDENTS
- SMALL COMPANIES

From Heath (2000)

GEOSCIENCE SKILLS NEEDED BY OIL COMPANIES

SKILLS (TOP SCORE = 100)	IMPORTANCE		
	MAJOR COMPANIES	LARGE INDEPENDENTS	SMALL COMPANIES
PLAY ASSESSMENT	70	85	90
REFLECT/REFRACTION SEISMIC GEOPHYSICS	68	56	63
APPLIED/OPERATIONS GEOPHYSICS	68	54	58
INTRODUCTORY STRUCTURAL GEOLOGY	64	73	65
2D & 3D MODELLING (SEISMIC MAPPING)	64	63	68
LOG/CORE ANALYSIS	64	63	68
SEDIMENTARY STRUCTURES	64	54	50
BIOSTRATIGRAPHY	61	53	43
SPECIAL ROCK STUDIES - CLASTICS	61	46	50

- MAJOR COMPANIES
- LARGE INDEPENDENTS
- SMALL COMPANIES

From Heath (2000)

GEOSCIENCE SKILLS NEEDED BY OIL COMPANIES

SKILLS (TOP SCORE = 100)	IMPORTANCE		
	MAJOR COMPANIES	LARGE INDEPENDENTS	SMALL COMPANIES
SPECIAL ROCK STUDIES - CARB. & EVAP.	57	48	33
GLOBAL GEOLOGY	57	46	48
ORGANIC GEOCHEMISTRY	54	73	53
ADVANCED STRUCTURAL GEOLOGY	54	48	58
INVERSION GEOPHYSICS	54	44	40
OPERATIONS GEOLOGY	50	46	58
FIELD & MAPPING SKILLS	50	46	35
GENERAL GEOCHEMISTRY	50	40	40
ROCK : FLUID INTERACTION	46	56	48

- MAJOR COMPANIES
- LARGE INDEPENDENTS
- SMALL COMPANIES

From Heath (2000)

GEOSCIENCE SKILLS NEEDED BY OIL COMPANIES

SKILLS (TOP SCORE = 100)	IMPORTANCE		
	MAJOR COMPANIES	LARGE INDEPENDENTS	SMALL COMPANIES
GENERAL PALEONTOLOGY	46	27	28
MARINE GEOLOGY	39	40	30
TIME - SERIES ANALYSIS	39	34	34
POTENTIAL FIELDS (GRAVITY & MAGNETICS)	36	40	43
MICROPALEONTOLOGY	32	35	33
ENVIRONMENTAL GEOLOGY	32	25	40
PALYNOLOGY	29	33	30
GEOMORPHOLOGY	29	17	15
TERRAIN ANALYSIS (REMOTE SENSING)	18	38	19
COAL GEOLOGY	18	15	15
RECENT, QUATERNARY OR SURFICIAL GEO.	16	29	15



MAJOR COMPANIES



LARGE INDEPENDENTS



SMALL COMPANIES

From Heath (2000)

SUMMARY: GEOSCIENCE SKILLS

- **MSc IS (OR WILL BE) MINIMUM GEOSCIENCE DEGREE QUALIFICATION**
- **ALL RESPONDENTS AGREE THAT FEW CORE SUBJECTS (EG SEDIMENTOLOGY, STRUCTURE, GEOPHYSICS) NEEDED**
- **MANY OF THE CLASSICAL COURSES (EG PALEONTOLOGY, PALYNOLOGY, GEOMORPHOLOGY) NOT CONSIDERED IMPORTANT**
- **MAJOR COMPANIES HAVE HIGHER EXPECTATIONS**
- **ALL COMPANIES WANT MULTI-DISCIPLINE SKILLS, WITH TOPICS INCLUDING SOME ENGINEERING, MATH AND PHYSICS, CHEMISTRY AS WELL AS G & G**

COMPUTER SKILLS NEEDED BY OIL COMPANIES

COMPUTER SKILLS		(TOP SCORE = 100)		IMPORTANCE
BASIC	SPREADSHEETS (LOTUS, EXCEL, etc.)	75	73	81
	ELECTRONIC COMMUNICATION (EMAIL)	75	73	75
	DESKTOP SYSTEMS (WINDOWS '95, MAC, etc.)	75	69	75
	WORD PROCESSING (WORD, DOS, etc.)	64	69	64
HARDWARE	PC	68	60	69
	UNIX	68	58	58
	EXPOSURE TO PERIPHERAL EQUIPMENT	31	46	44
GRAPHICS	PRESENTATION (POWERPOINT, etc.)	64	60	58
	ADVANCED (COREL DRAW, etc.)	29	31	36

From Heath (2000)

- MAJOR COMPANIES
- LARGE INDEPENDENTS
- SMALL COMPANIES

COMPUTER SKILLS NEEDED BY OIL COMPANIES

COMPUTER SKILLS		(TOP SCORE = 100)		IMPORTANCE		
INTERNET	SEARCHING	46	54	56		
	APPLICATION (FTP, TELNET, etc.)	43	42	31		
PROGRAMMING	INTRODUCTION	25	18	13		
	ADVANCED	25	18	13		
DATA BASES	SIMPLE (FOXPRO, ACCESS, DBASE, PARADOX)	36	40	25		
	ADVANCED (ORACLE)	29	29	22		
	DESIGN & MANAGEMENT	8	27	11		
GIS	SIMPLE (ARC VIEW, MAP INFO)	43	42	44		
	ADVANCED (ARC INFO, SPAN)	25	23	22		

From Heath (2000)

- MAJOR COMPANIES
- LARGE INDEPENDENTS
- SMALL COMPANIES

COMPUTER SKILLS NEEDED BY OIL COMPANIES

COMPUTER SKILLS		(TOP SCORE = 100)			IMPORTANCE		
GEO SCIENCE SPE CIFIC OPERATIONS	EXPOSURE TO INTERP. SYSTEMS	68	58	58			
	RESOURCE/RESERVE CALCULATIONS (GSLIB)	50	50	53			
	GEO PHYSICAL MODE LLING	50	44	53			
	GEOLOGICAL MODE LLING	50	35	50			
	STATISTICAL DATA (SAS, etc.)	50	42	50			
	GEO PHYSICAL PROCESSING	46	38	53			
	GEOCHEMISTRY - APPLICATIONS	36	42	42			
	GEOCHEMISTRY - SPATIAL (GEOSOFT, SURFER)	36	27	22			
	EXPLORATION & MAPPING PACKAGES	32	36	28			

From Heath (2000)

- MAJOR COMPANIES
- LARGE INDEPENDENTS
- SMALL COMPANIES

SUMMARY: COMPUTER SKILLS

- **FEW SCORES EXCEED 60 - REFLECTING THAT GEOSCIENCE SKILLS VIEWED AS MORE IMPORTANT**
- **KEY SKILLS IDENTIFIED AS 'CRITICAL':**
 - **SPREADSHEETS**
 - **UNIX HARDWARE**
 - **PRESENTATION GRAPHICS**
 - **INTERPRETATION SYSTEMS**



NON-TECHNICAL & SOFT SKILLS NEEDED BY OIL COMPANIES

SKILLS (TOP SCORE = 100)	IMPORTANCE		
	MAJOR COMPANIES	LARGE INDEPENDENTS	SMALL COMPANIES
INITIATIVE	93	93	80
ETHICS/INTEGRITY	93	91	85
WILLINGNESS TO LEARN	93	86	78
ADAPTABILITY/FLEXIBILITY (JOB, LOCATION)	93	84	83
COMMITMENT	89	80	85
CAN SUMMARIZE KEY ISSUES/ABSTRACT	89	88	83
DESIRE TO ACHIEVE/MOTIVATION	89	86	85
COOPERATION	89	86	83
ANALYTICAL SKILLS	89	86	78
CAN COPE WITH STRESS	89	84	83
DRIVE/ENERGY/ENTHUSIASM	86	91	85
DEPENDABILITY/RELIABILITY	86	84	88

- MAJOR COMPANIES
- LARGE INDEPENDENTS
- SMALL COMPANIES

From Heath (2000)

NON-TECHNICAL & SOFT SKILLS NEEDED BY OIL COMPANIES

SKILLS (TOP SCORE = 100)	IMPORTANCE		
	MAJOR COMPANIES	LARGE INDEPENDENTS	SMALL COMPANIES
SELF-MANAGEMENT/SELF-CONTROL	86	84	83
TEAMWORK	86	82	73
LISTENING	86	82	70
TAKING RESPONSIBILITY/SELF-RELIANCE	86	79	78
PROBLEM SOLVING ABILITY	86	77	80
TIME MANAGEMENT	86	68	83
ORAL COMMUNICATION	82	84	83
LOGICAL ARGUMENT/REASONING	82	82	75
SELF-CONFIDENCE	82	75	70
RESEARCH OR ENQUIRY SKILLS	82	67	73
CULTURAL FLEXIBILITY/AWARENESS	82	56	70
CREATIVITY/OUT-OF-THE-BOX THINKING	79	79	80



MAJOR COMPANIES



LARGE INDEPENDENTS



SMALL COMPANIES

From Heath (2000)

NON-TECHNICAL & SOFT SKILLS NEEDED BY OIL COMPANIES

SKILLS (TOP SCORE = 100)	IMPORTANCE		
	MAJOR COMPANIES	LARGE INDEPENDENTS	SMALL COMPANIES
CAN OVERCOME ADVERSITY	79	77	68
INTELLECTUAL ABILITY/INTELLIGENCE	79	55	65
WRITTEN COMMUNICATION	75	75	80
RAPID CONCEPTUALIZATION OF IDEAS	74	73	68
SPATIAL THINKING	75	66	70
LEADERSHIP (PAST RESPONSIBILITIES)	71	68	60
ENTREPRENEURIAL FLAIR/SKILLS	68	68	60
NUMERACY	68	50	58
INTERNATIONAL LIVING/TRAVEL EXPERIENCE	64	46	53
RISK TAKER	57	59	65

- MAJOR COMPANIES
- LARGE INDEPENDENTS
- SMALL COMPANIES

From Heath (2000)

SUMMARY: NON-TECHNICAL, SOFT SKILLS

- **THE HIGH SCORES DEMONSTRATE THE IMPORTANCE ATTRIBUTED TO THESE SKILLS**
- **MOST OF THE TOP 15 ATTRIBUTES ARE CLOSELY LINKED TO INNATE “PEOPLE” SKILLS OR ATTITUDE OF STUDENT**
- **RESEARCH BACKGROUND IS RELATIVELY UNIMPORTANT UNLESS IT HAS HAD PRACTICAL APPLICATION**
- **RISK TAKING, CULTURAL AWARENESS AND LANGUAGE SKILLS ARE NOT VIEWED IMPORTANT**

OVERALL SUMMARY

RELATIVE IMPORTANCE OF EXPECTED SKILLS FOR NEW HIRES

	MAJOR COMPANIES	LARGE COMPANIES	SMALL COMPANIES
GEOSCIENCE SKILLS	65.4	61.9	60.1
COMPUTER SKILLS	43.3	42.2	42.3
NON-TECHNICAL & SOFT SKILLS	81.2	75.1	74.8

(Score out of possible 100)

After Heath (2000)

A PARADOX

A GROUP OF LINE MANAGERS AND RECRUITERS
WERE ASKED:

"WHAT SHOULD A PETROLEUM CURRICULUM STRESS?"

EDUCATION
VS
TRAINING

SCIENCE
VS
TECHNOLOGY

A PARADOX

WHAT SHOULD A PETROLEUM CURRICULUM STRESS?

LINE MANAGERS:

TRAINING

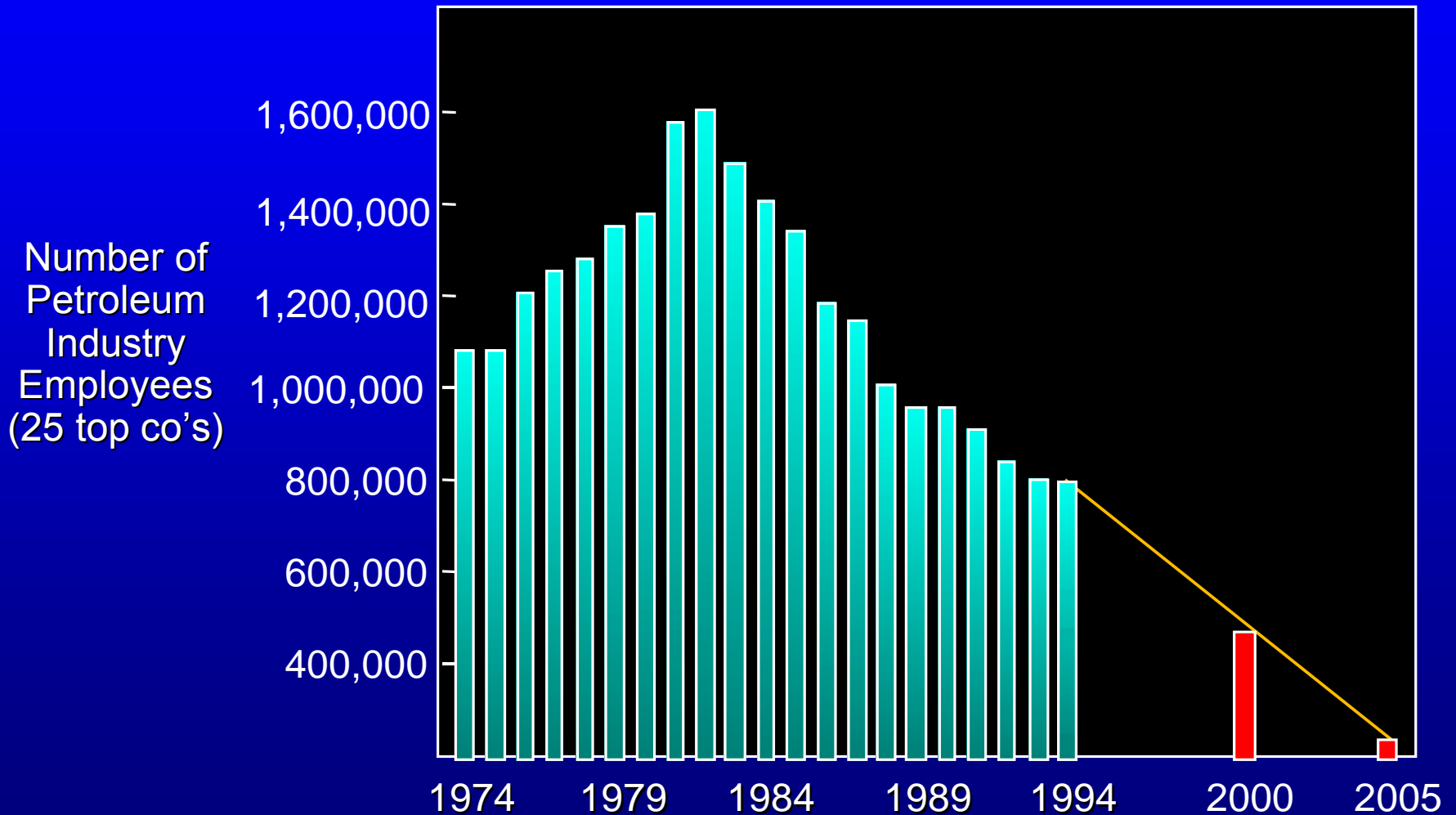
TECHNOLOGY

RECRUITERS:

EDUCATION

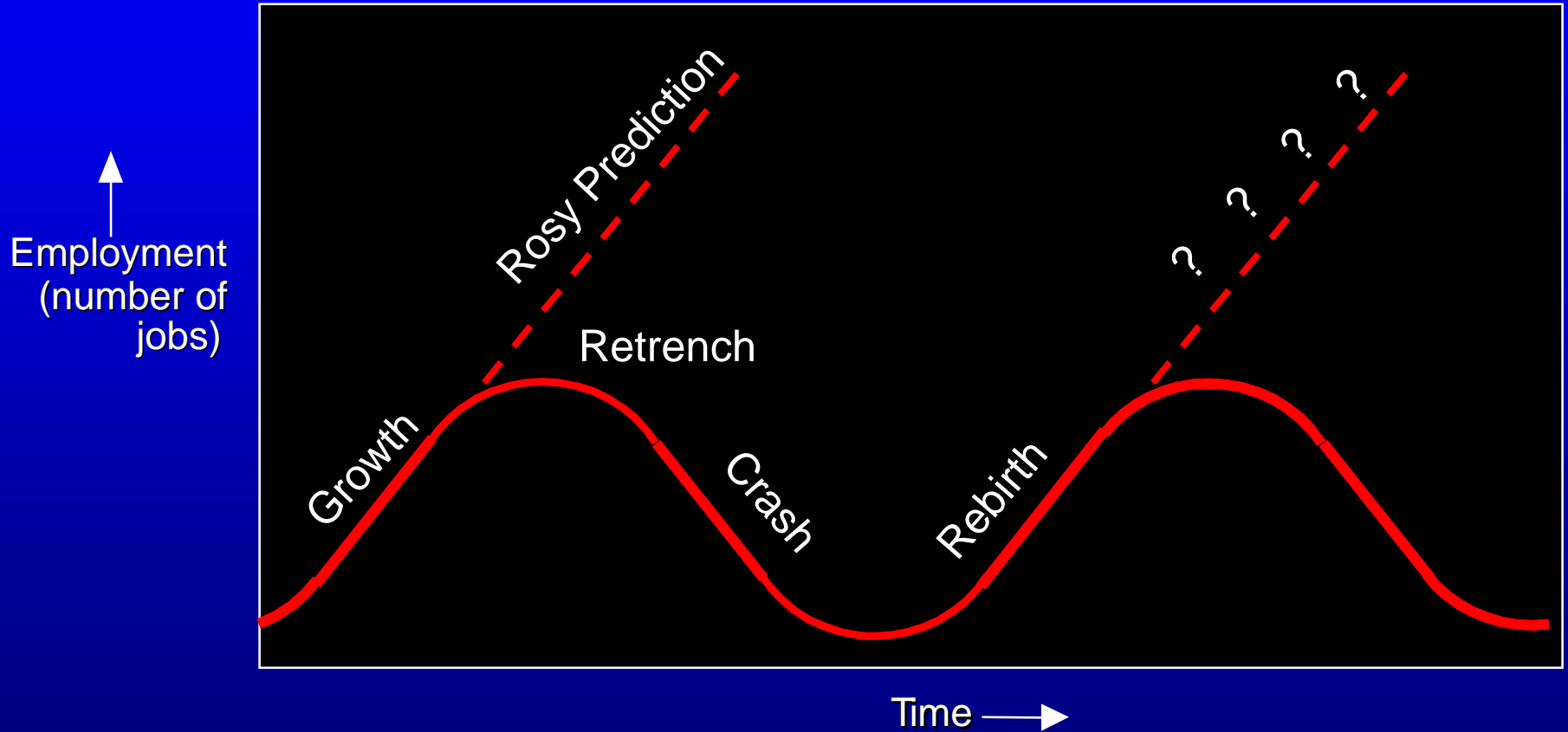
SCIENCE

Employment Scenario



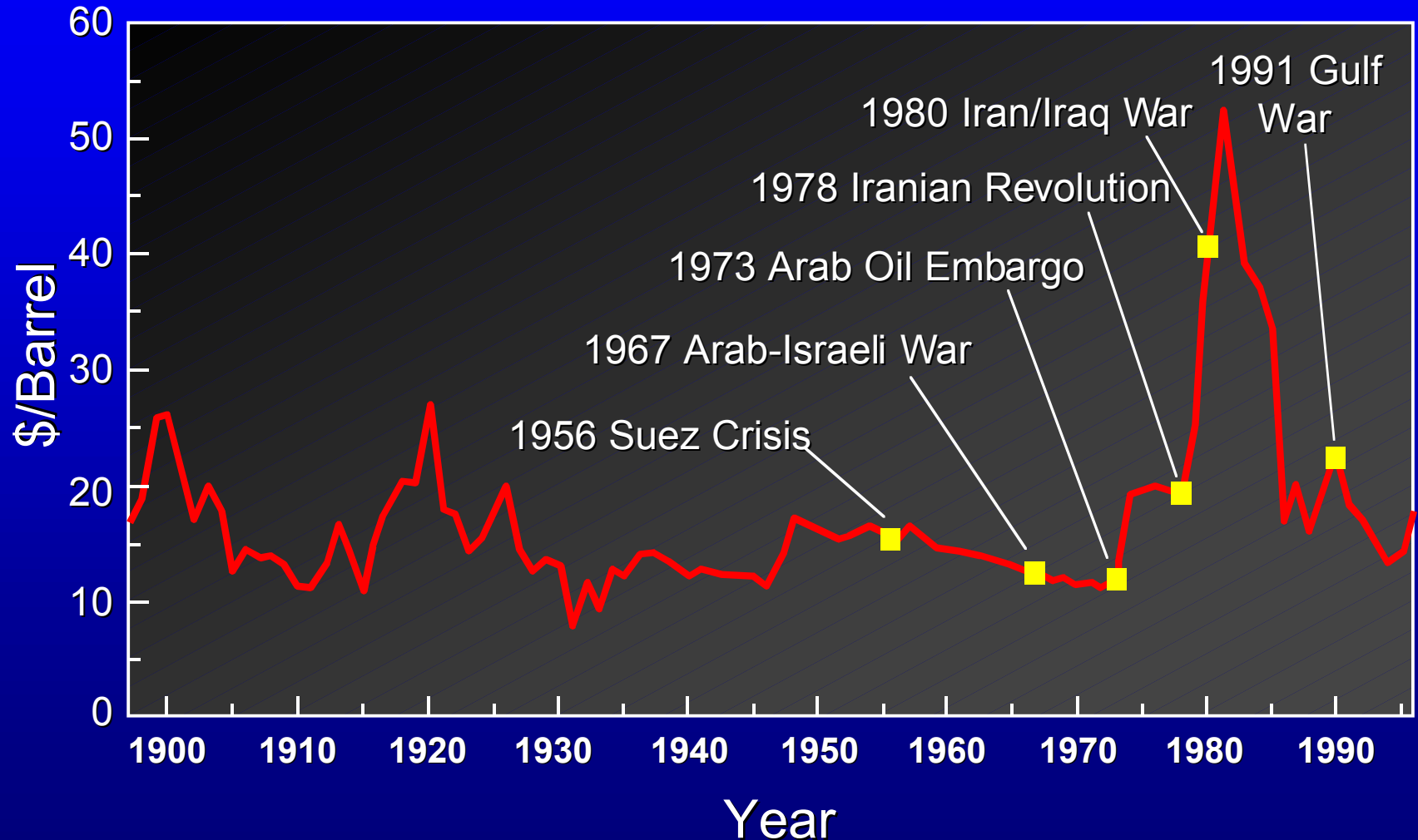
Cyclic Job Market

Typical of Today's Global Industries



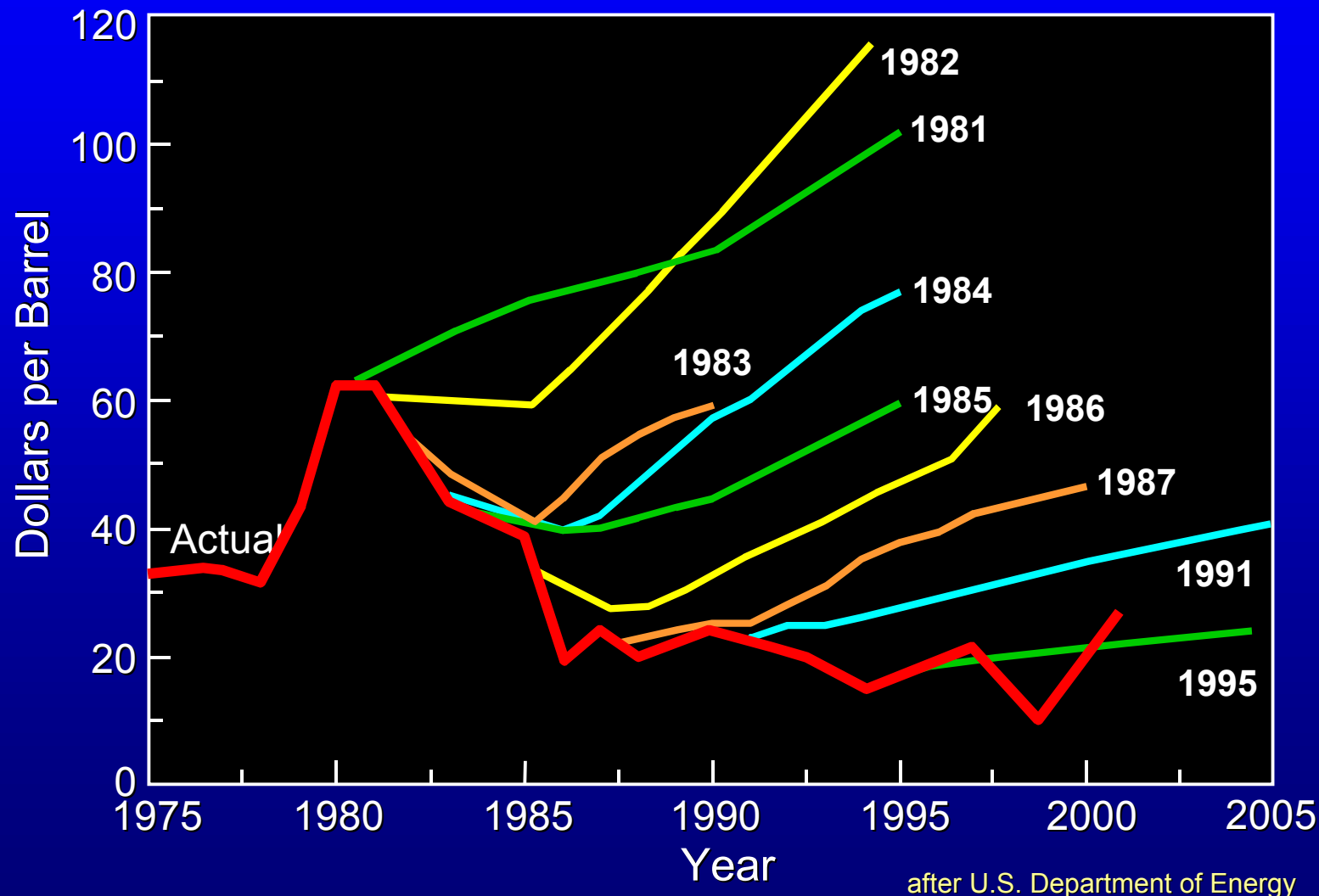
USA Average Wellhead Oil Price

Oil Price (1996 Dollars/Barrel)



DOE Oil Price Forecasts

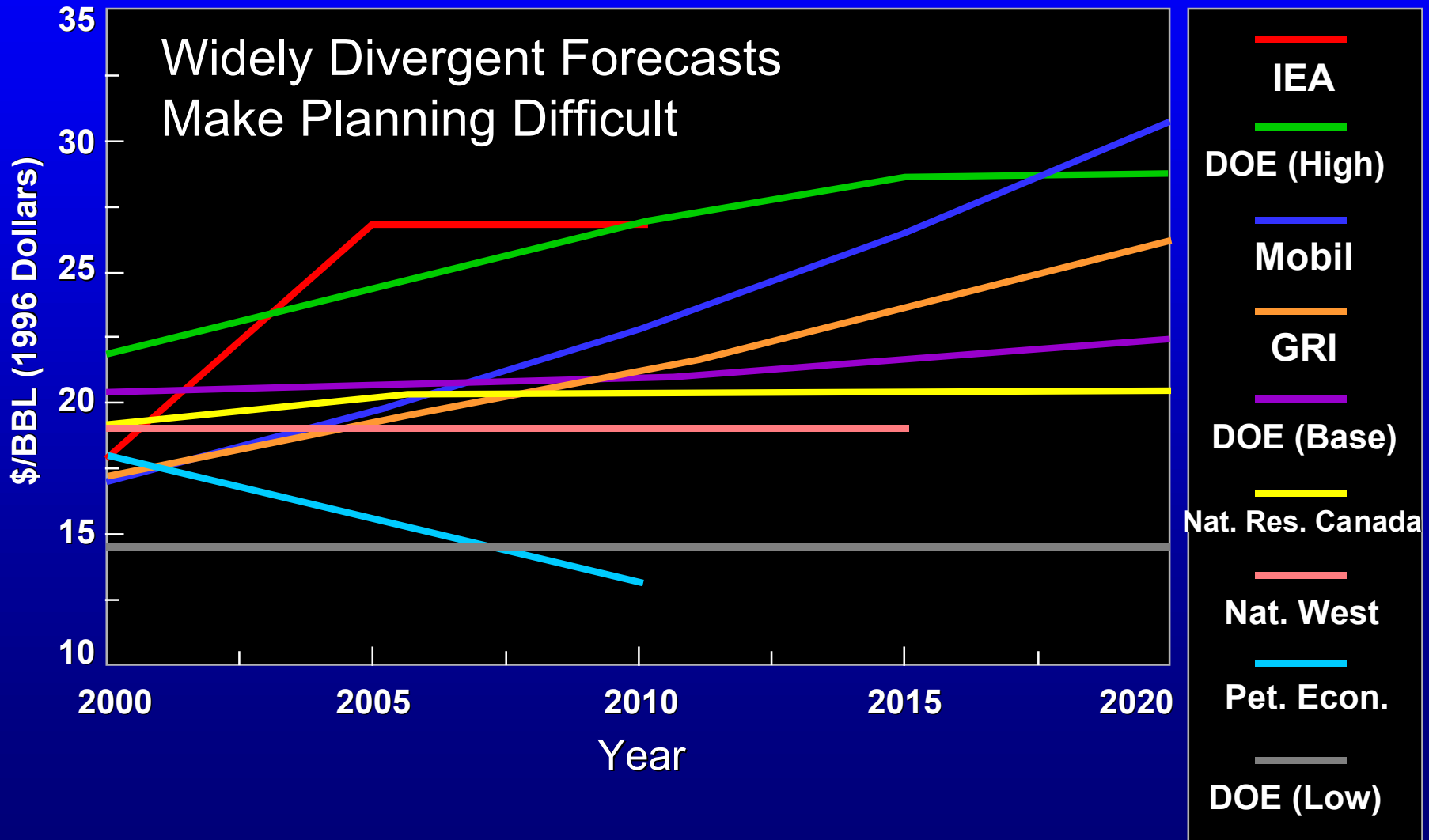
Linear Trends Predicted Beginning From the Actual Price of Year Listed



after U.S. Department of Energy

1998 Oil Price Forecasts

Nine Organizations



Why There is Still a Viable Future With Oil Companies

Four Reasons:

- Market Forces
 - Demographics
 - International Opportunities
 - New Technology

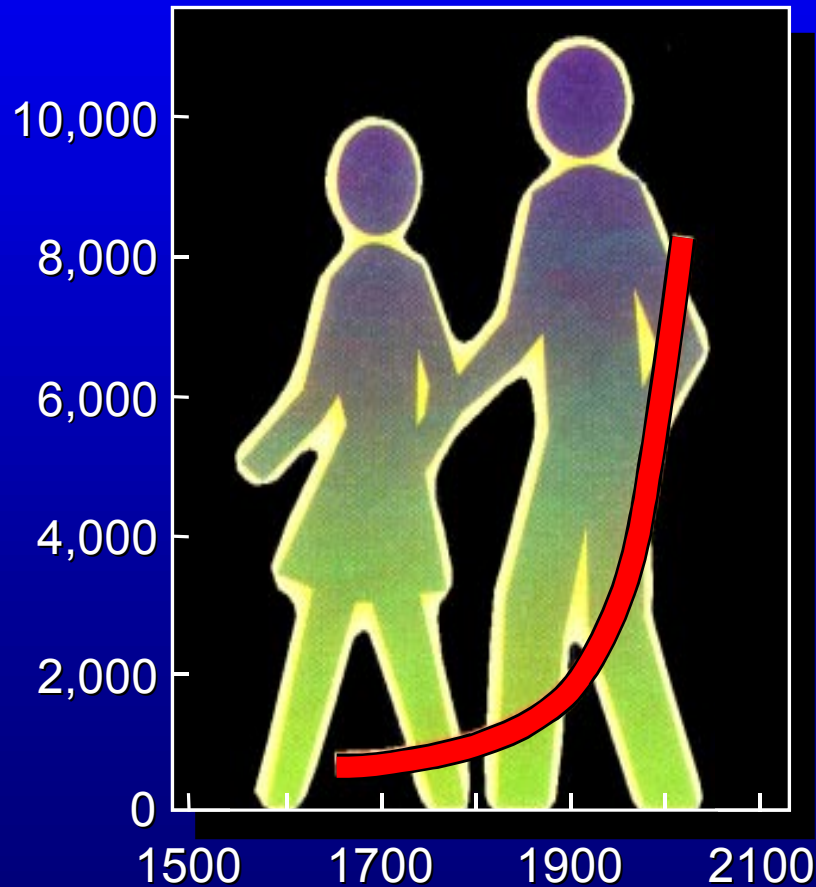
Why There is Still a Viable Future With Oil Companies

Four Reasons:

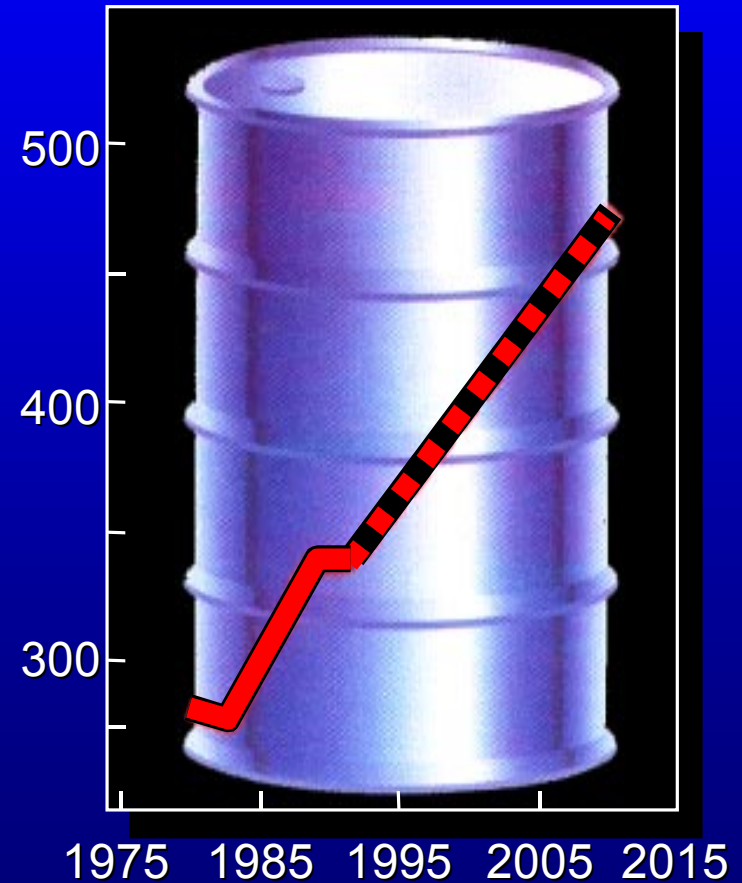
- **Market Forces**
 - Demographics
 - International Opportunities
 - New Technology

Population-Driven Energy Demand

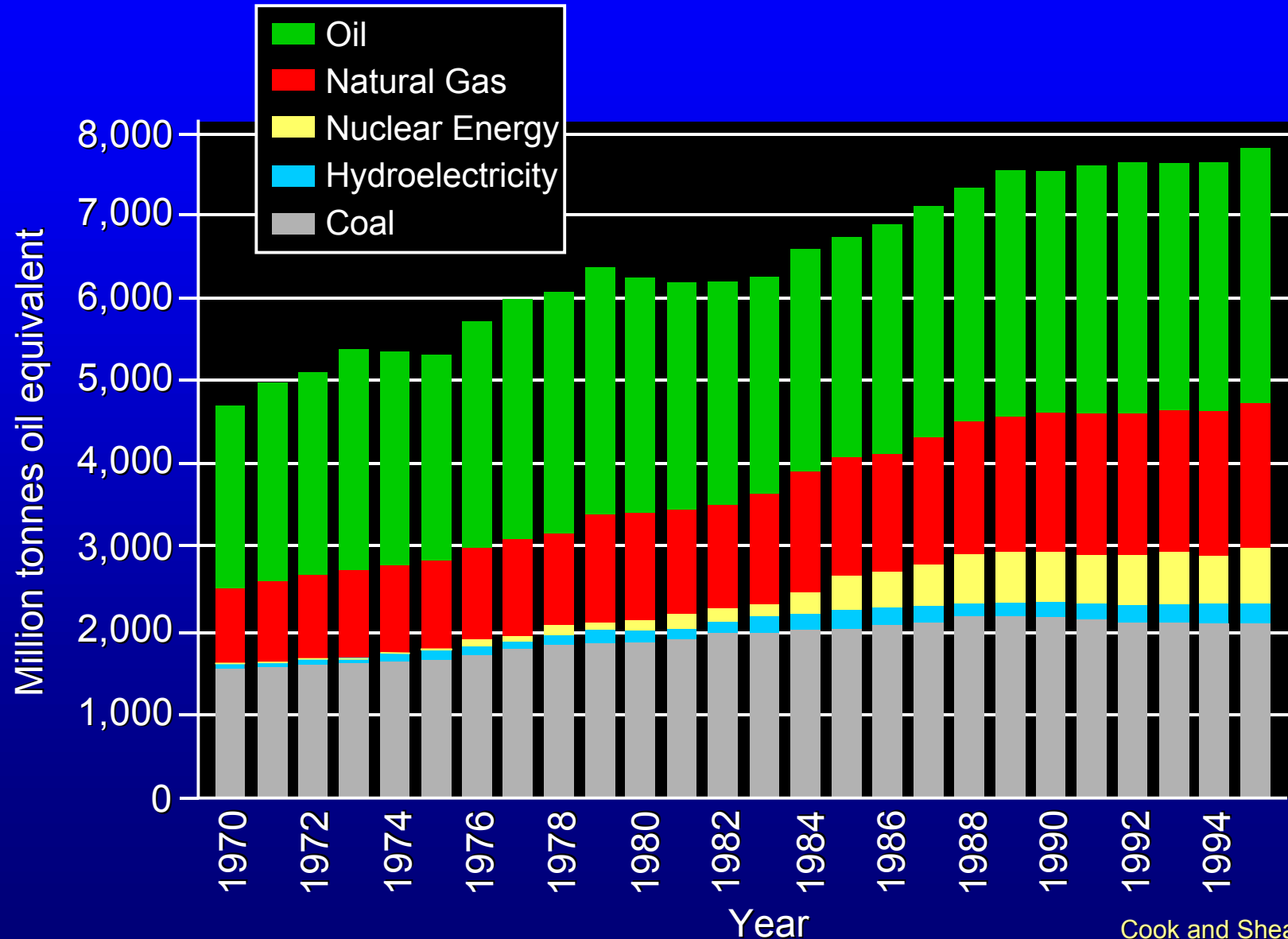
World Population
(Millions)



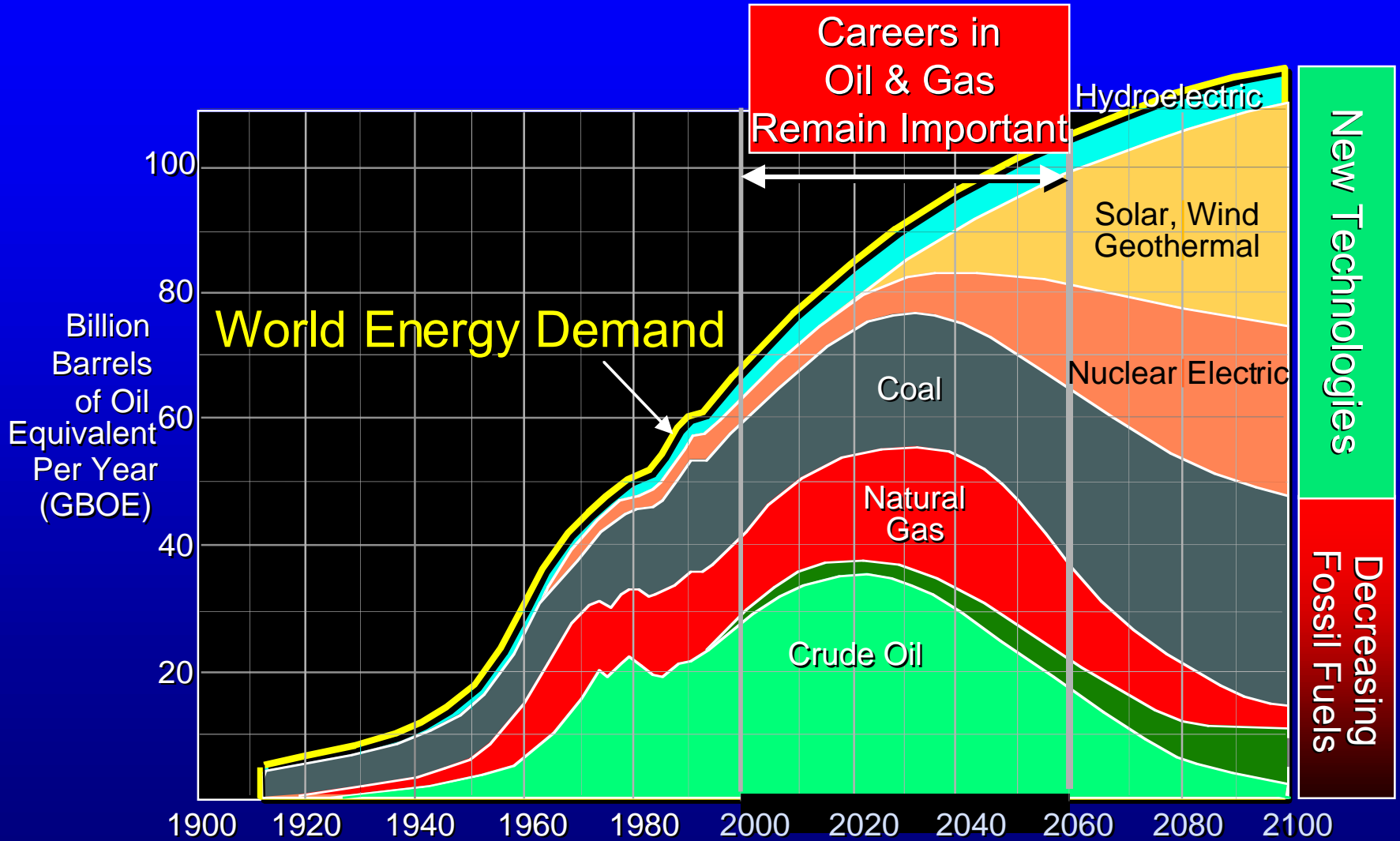
World Primary Energy
Consumption
(Quadrillion BTU)



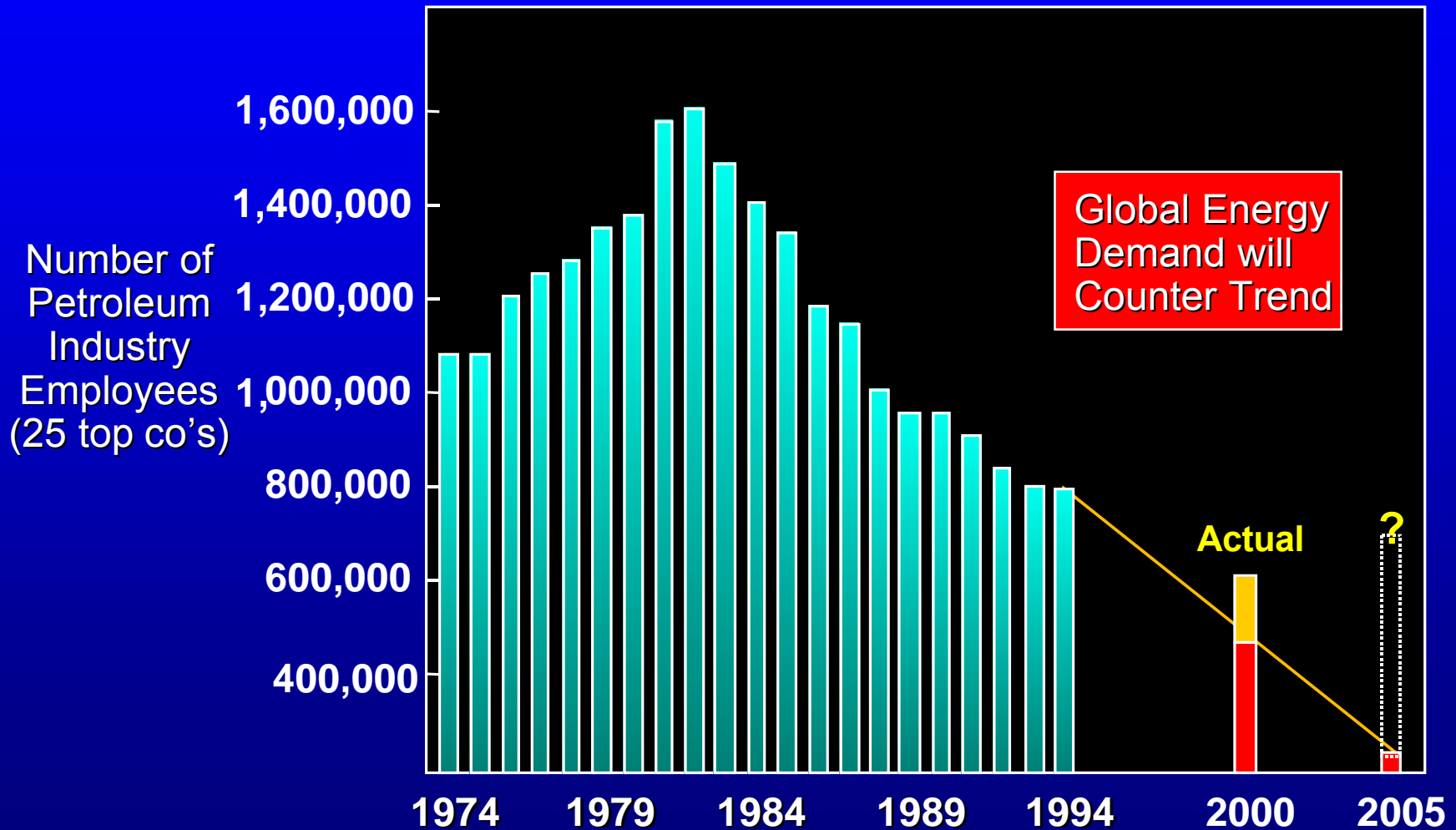
World Fuel Consumption: 1970-1994



Projected World Energy Supplies



More Realistic Employment Scenario

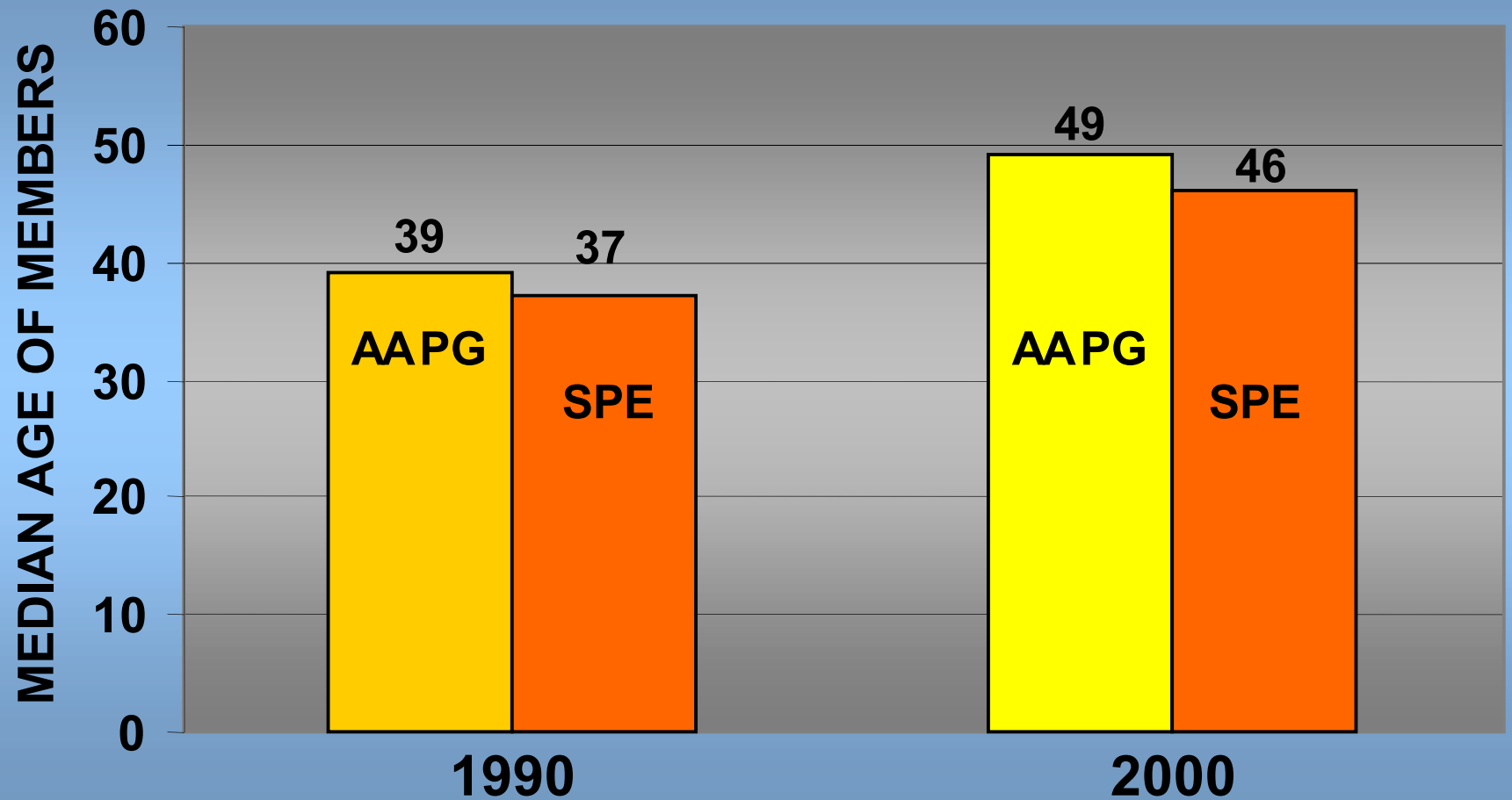


Why There is Still a Viable Future With Oil Companies

Four Reasons:

- Market Forces
- Demographics
- International Opportunities
- New Technology

MEDIAN AGE OF AAPG / SPE MEMBERS

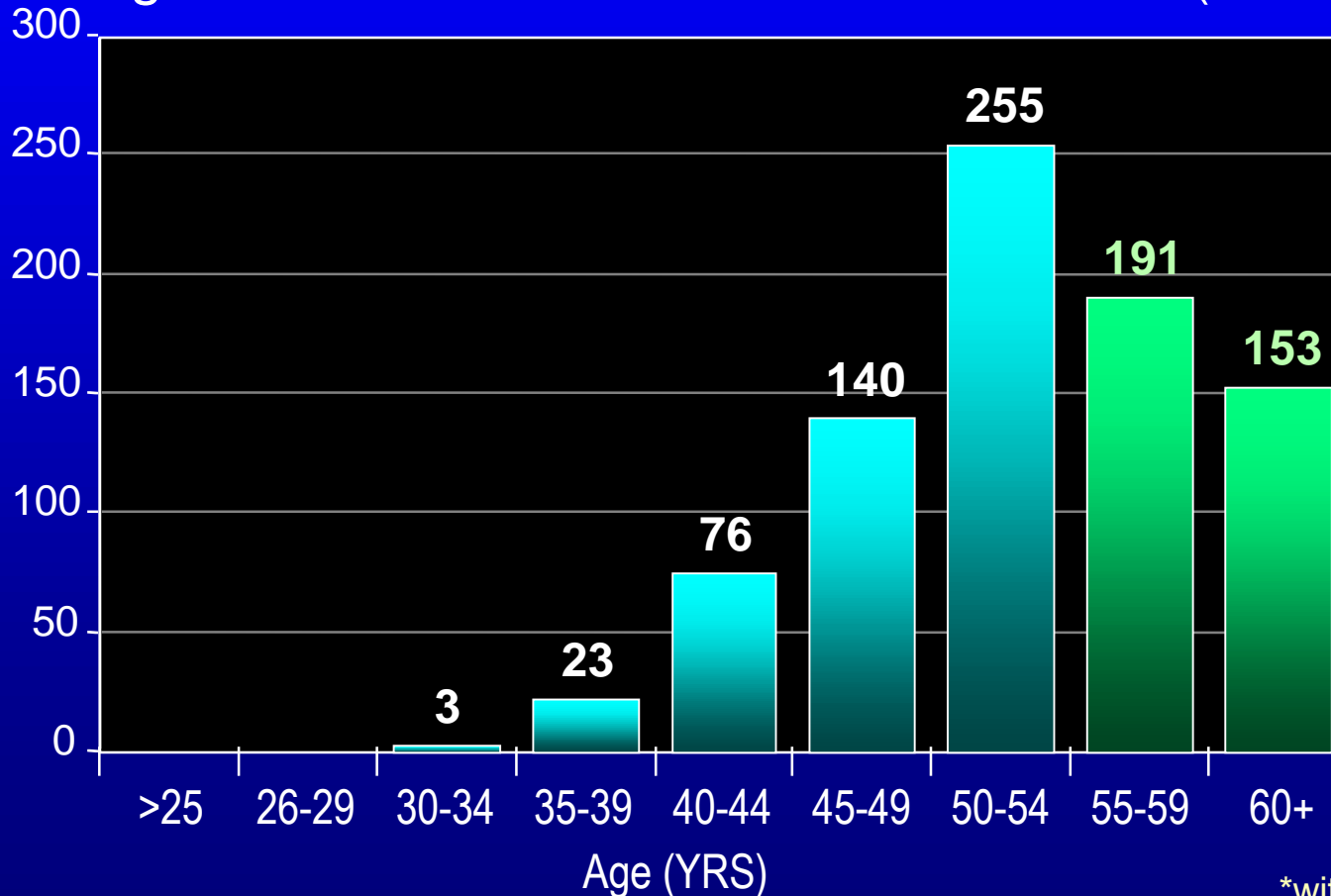


From AAPG/SPE

Geoscience Demographics

(For a Major Oil Company)

Age Brackets for Geoscientists Worldwide (2008*)



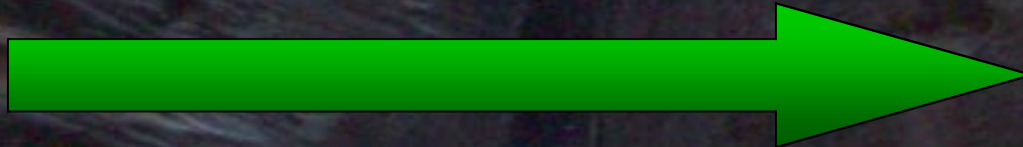
*with normal attrition and no replenishment

- 
- OUR INDUSTRY IS GREYING
 - THE MENTORS IN THE MAJOR COMPANIES ARE GONE
 - THE TRAINING PROGRAMS IN THE MAJOR COMPANIES ARE GONE
 - THE RESEARCH CENTRES IN THE MAJOR COMPANIES ARE GONE
 - A LARGE NUMBER OF THE MAJOR COMPANIES ARE GONE
 - IN 10 YEARS MOST OF US TEACHING YOU WILL BE GONE

THE PRODUCTIVITY “GAP”

8 YEARS

UNIVERSITY



PRODUCTIVE
PETROLEUM
ENGINEER /
GEOSCIENTIST

PRODUCTIVE PETROLEUM GEOSCIENTIST



MSc

Industry hire



Hons.



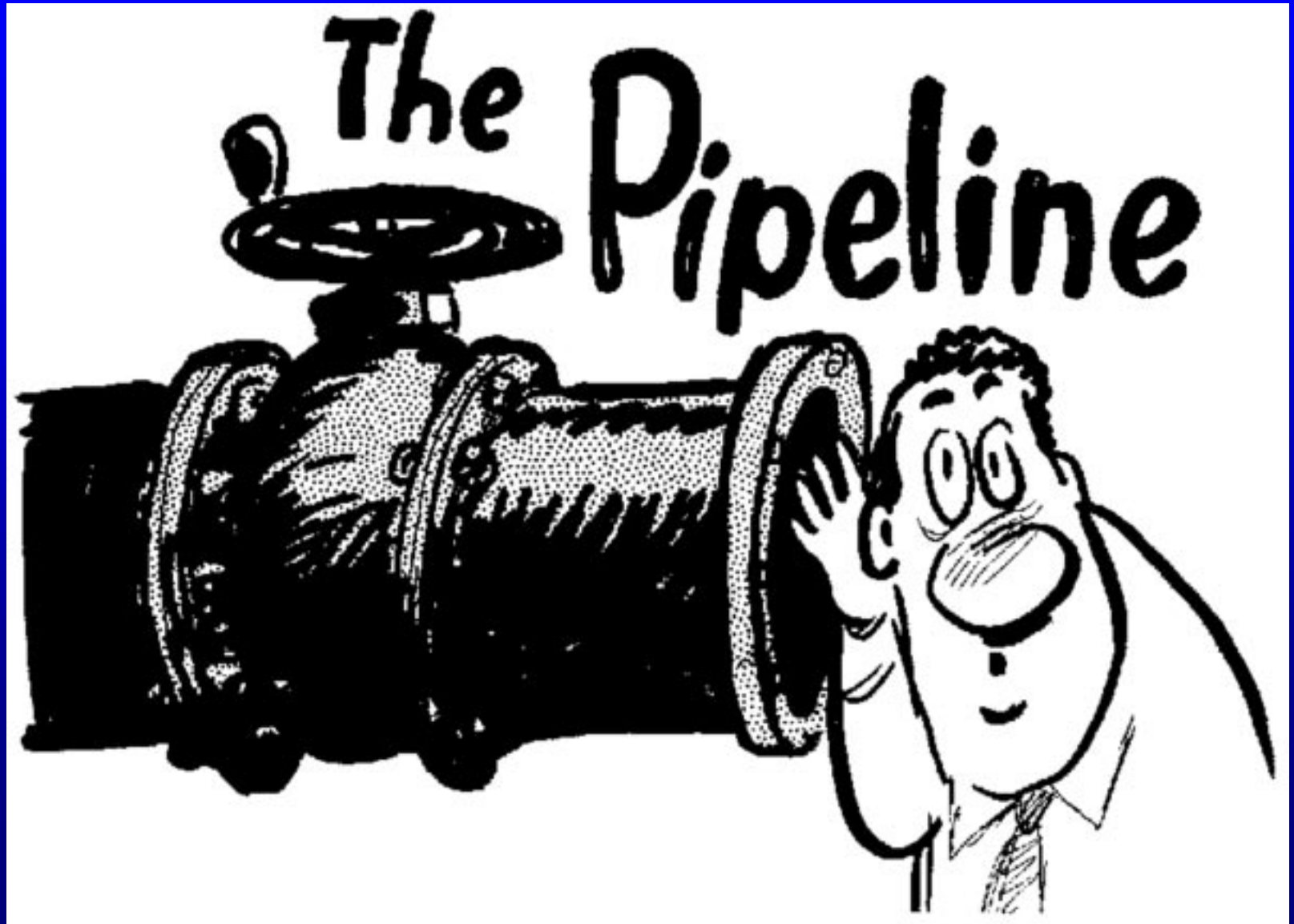
The
Internet

BSc

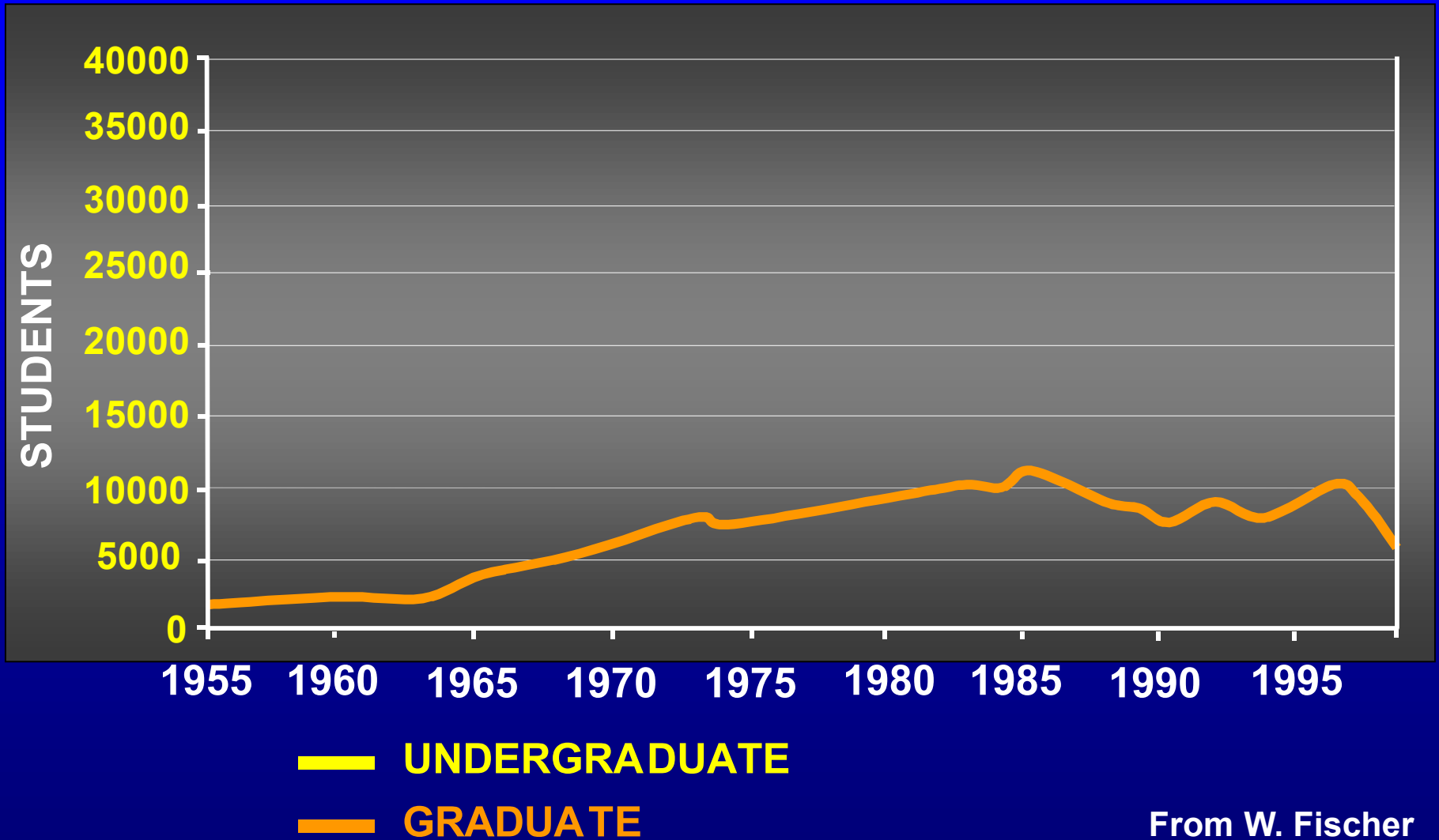
START UNI



What's In The Pipeline?

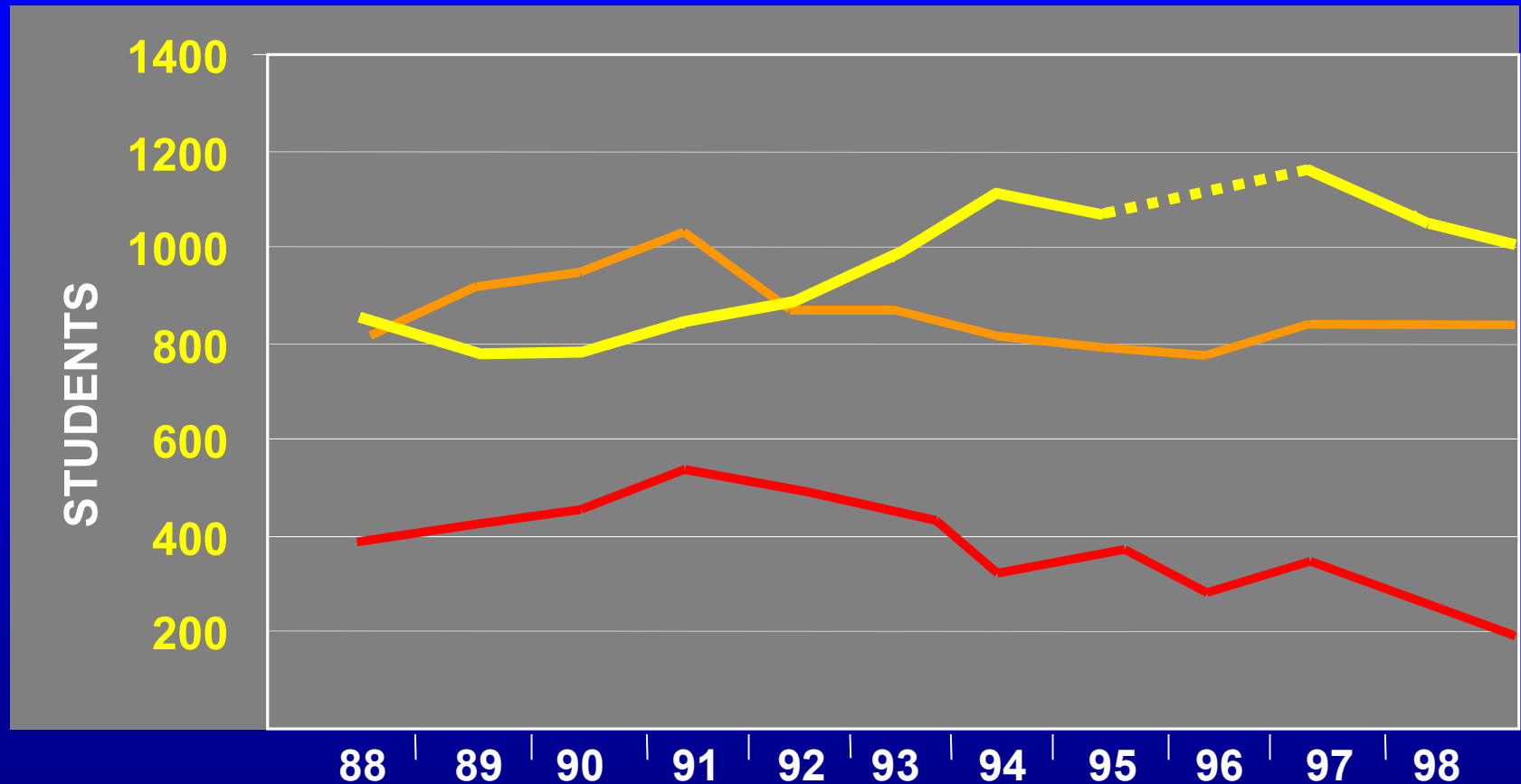


GEOSCIENCE STUDENTS AT US UNIVERSITIES



From W. Fischer

GEOSCIENCE STUDENTS AT NON-U.S. UNIVERSITIES



- Diplomas at German Universities**
- Graduates at British Universities**
- Honours at Australian Universities**

From Bottomley, 1999;
D.I.S.T., 2001

2002 Geological Salary Survey

Salaries for New hires (with 0-2 years experience)

\$75,000

High

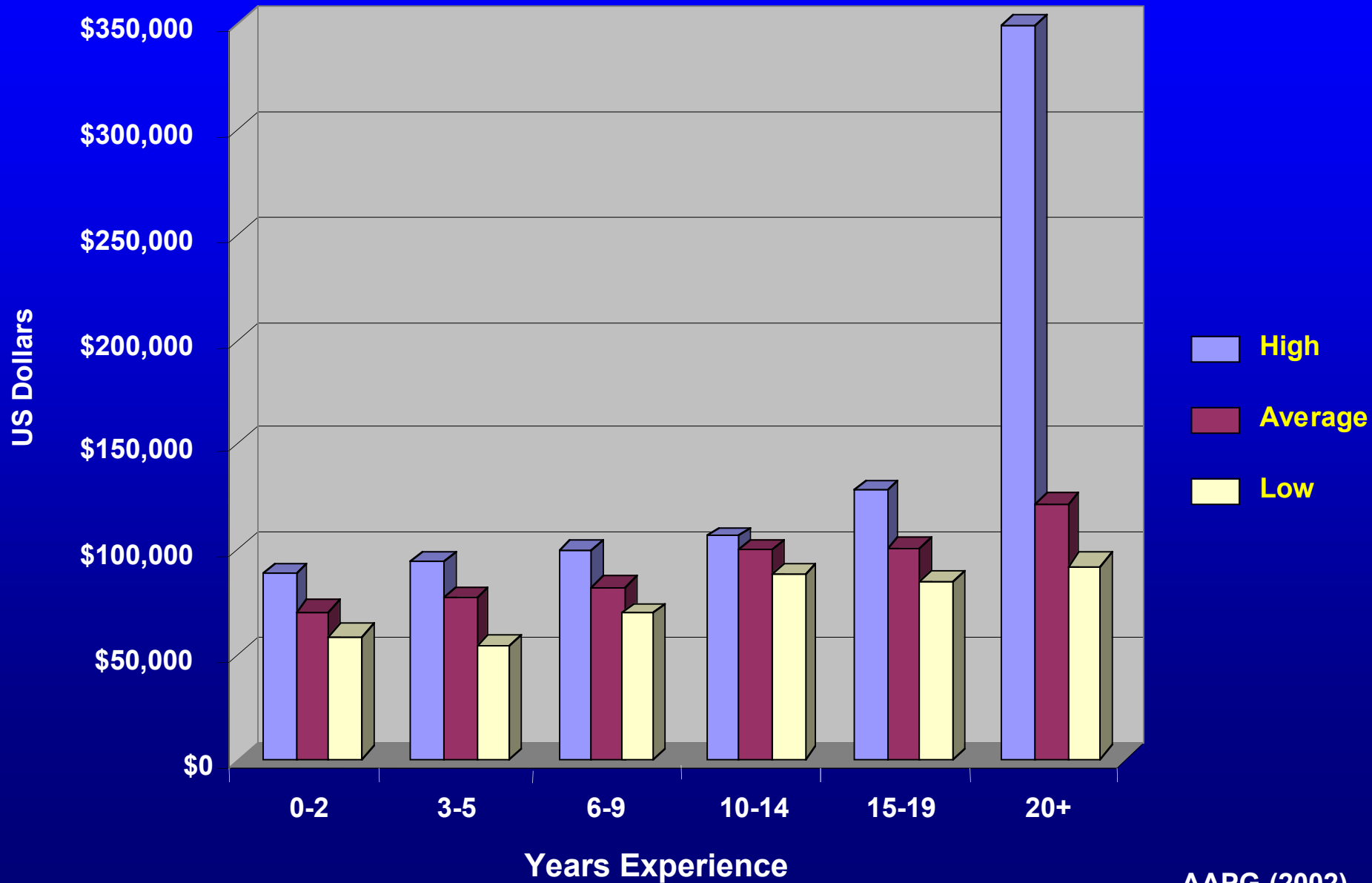
\$64,000

Average

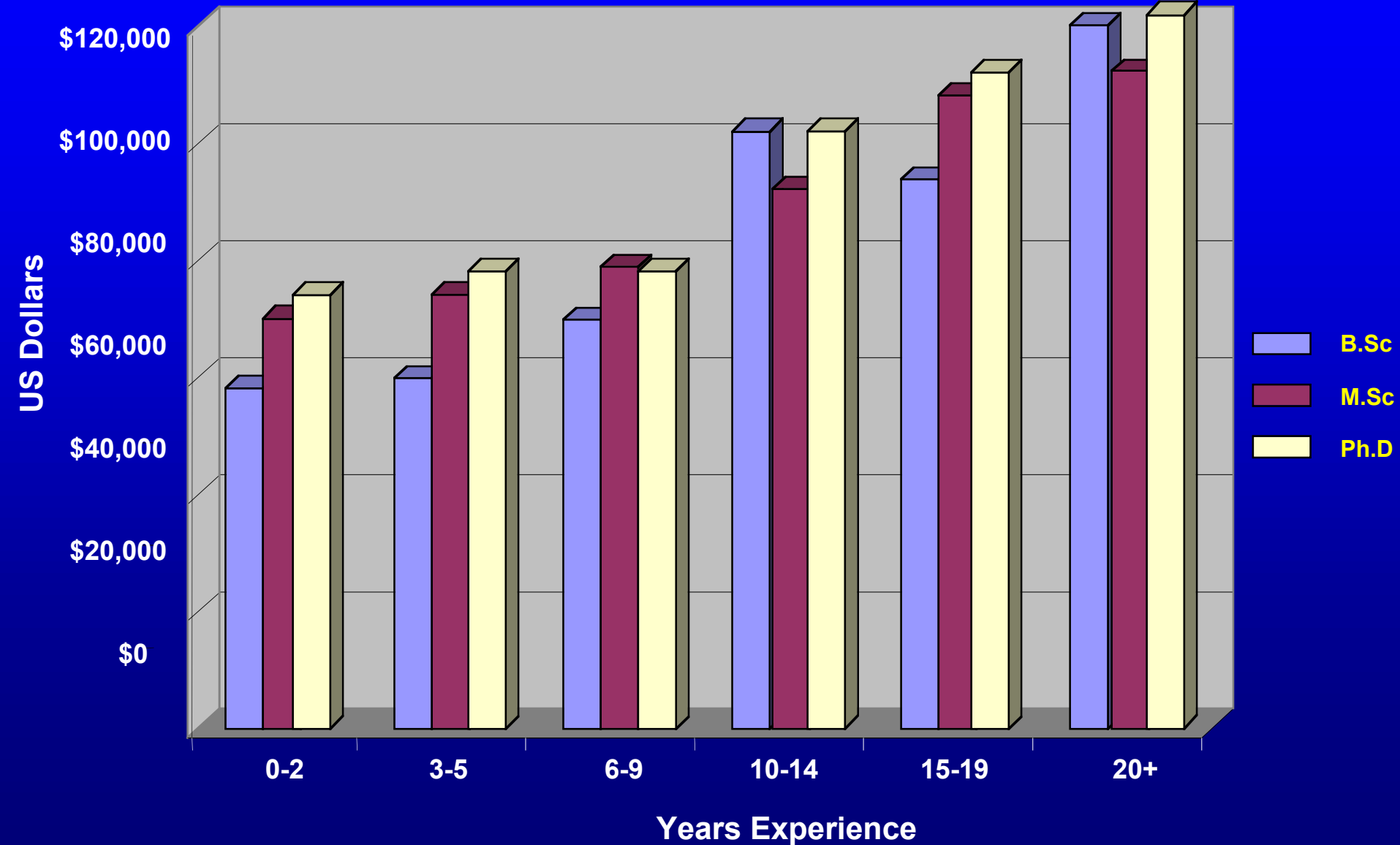
\$55,000

Low

2002 Geological Salary Survey



Average Salary by Degree



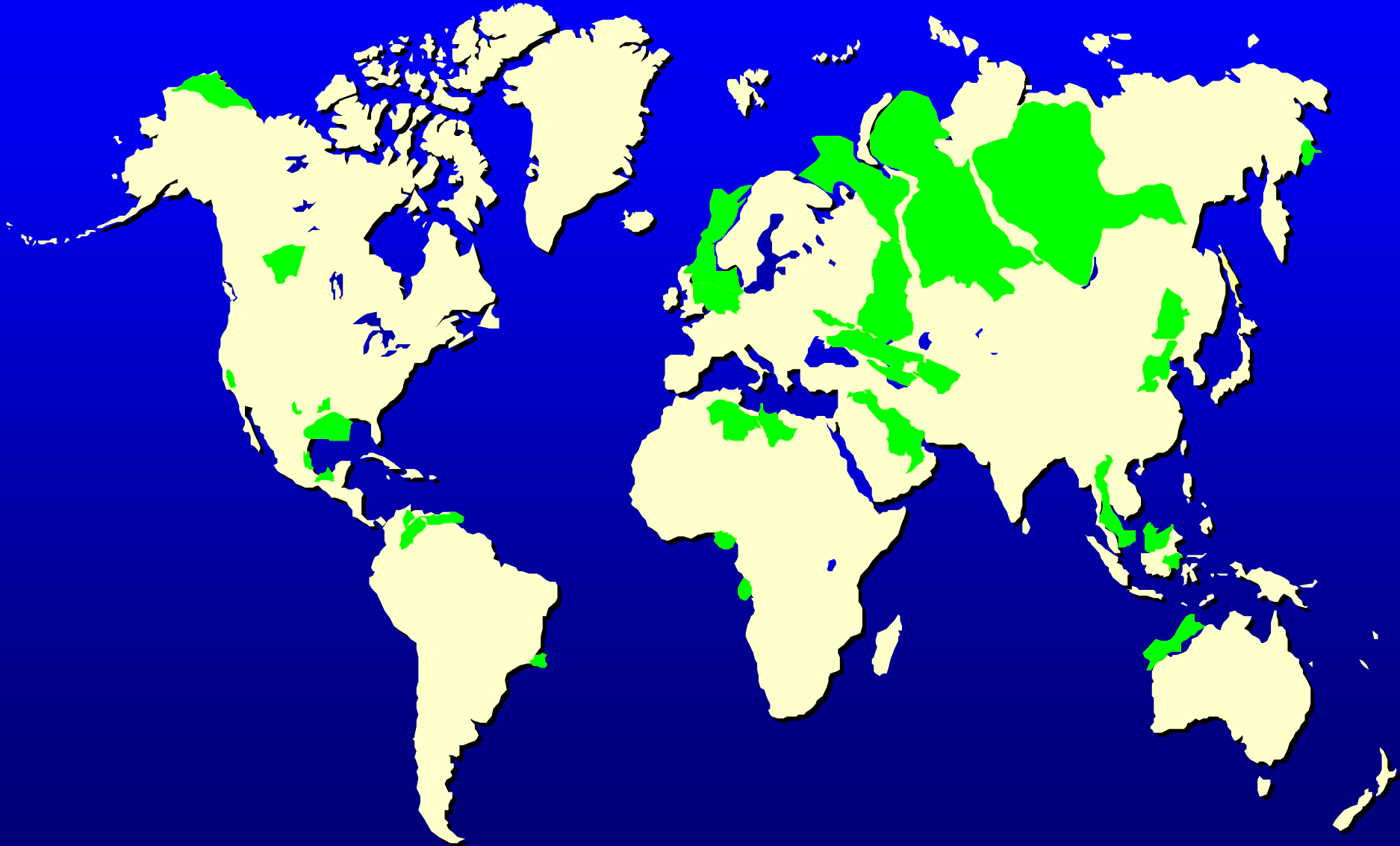
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Four Reasons:

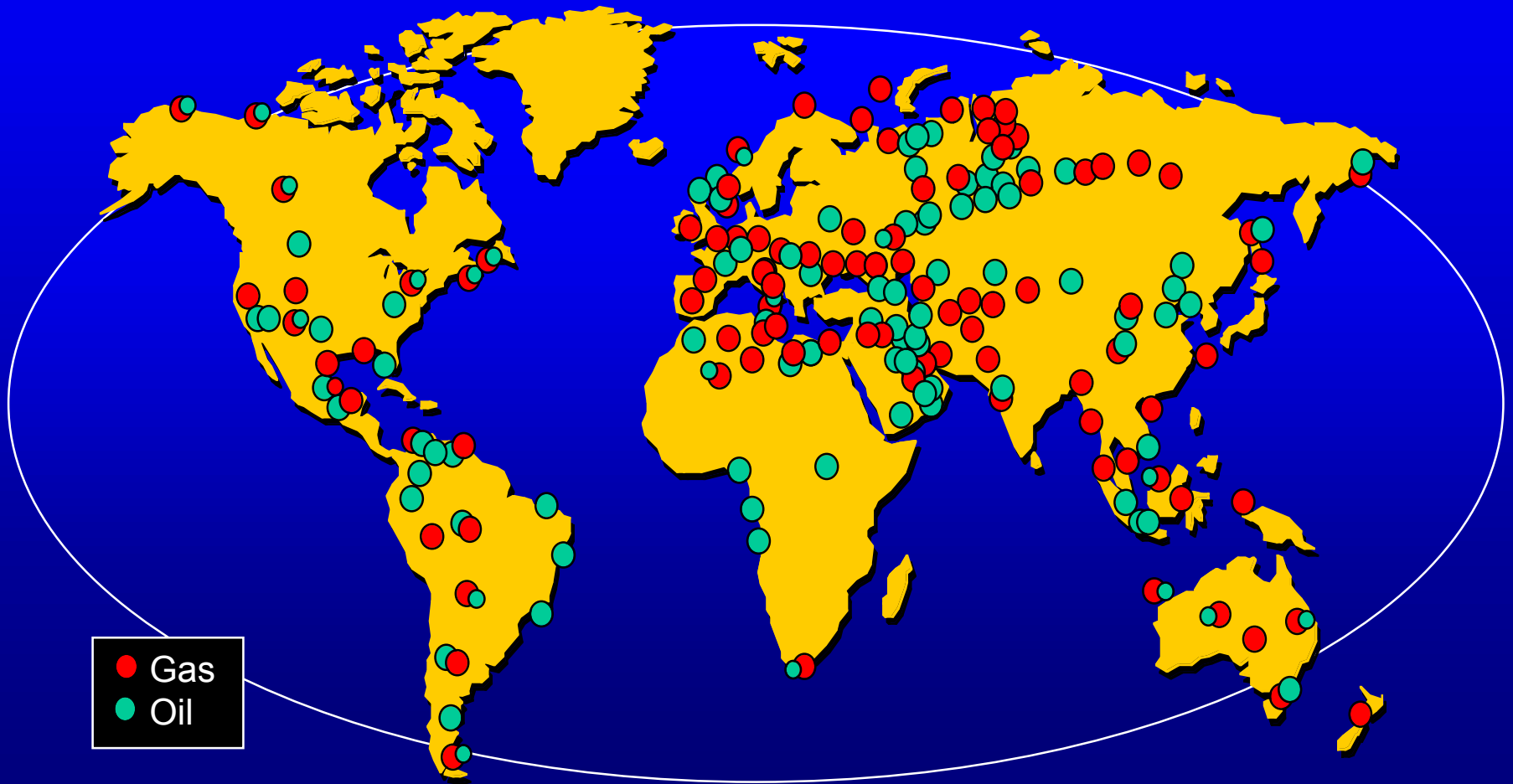
- Market Forces
 - Demographics
 - International Opportunities
 - New Technology

Largest Hydrocarbon Basins

by Ultimate Potential



Global Giant Oil and Gas Fields



Global Exploration

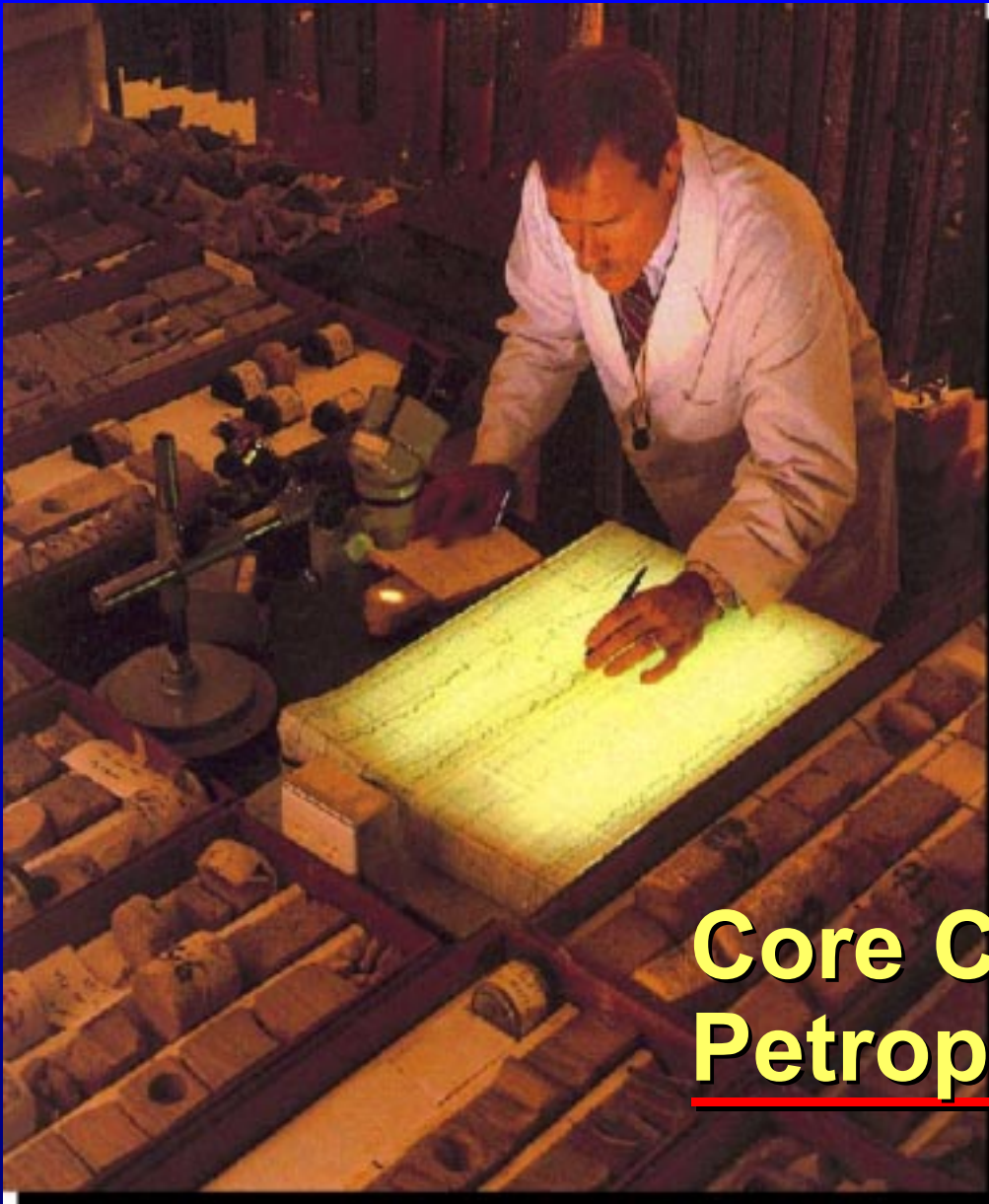
Opportunities for Future Growth



Why There is Still a Viable Future With Oil Companies

Four Reasons:

- Market Forces
 - Demographics
 - International Opportunities
 - **New Technology**

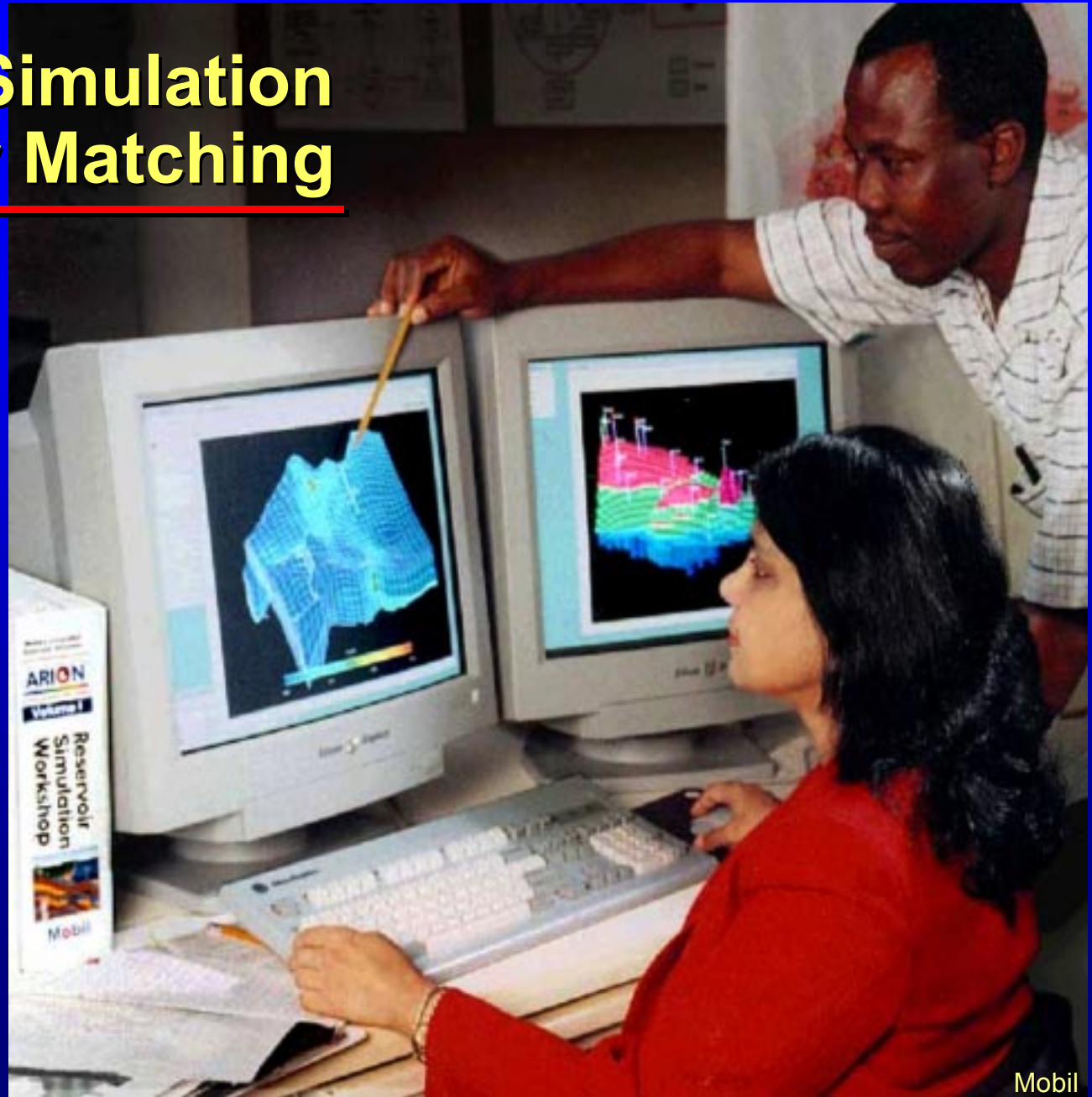


Core Calibration for Petrophysical Analysis

Geologic Data Analysis



Computer Simulation and History Matching





**Synergistic Technologies
Integrated Workstation
Applications
&
Visualisation Capabilities**

**NCPGG / Schlumberger Joint
Training and Research Centre
(Univ Adelaide)**

**FORMER PARADIGM:
ISOLATED RESEARCH**



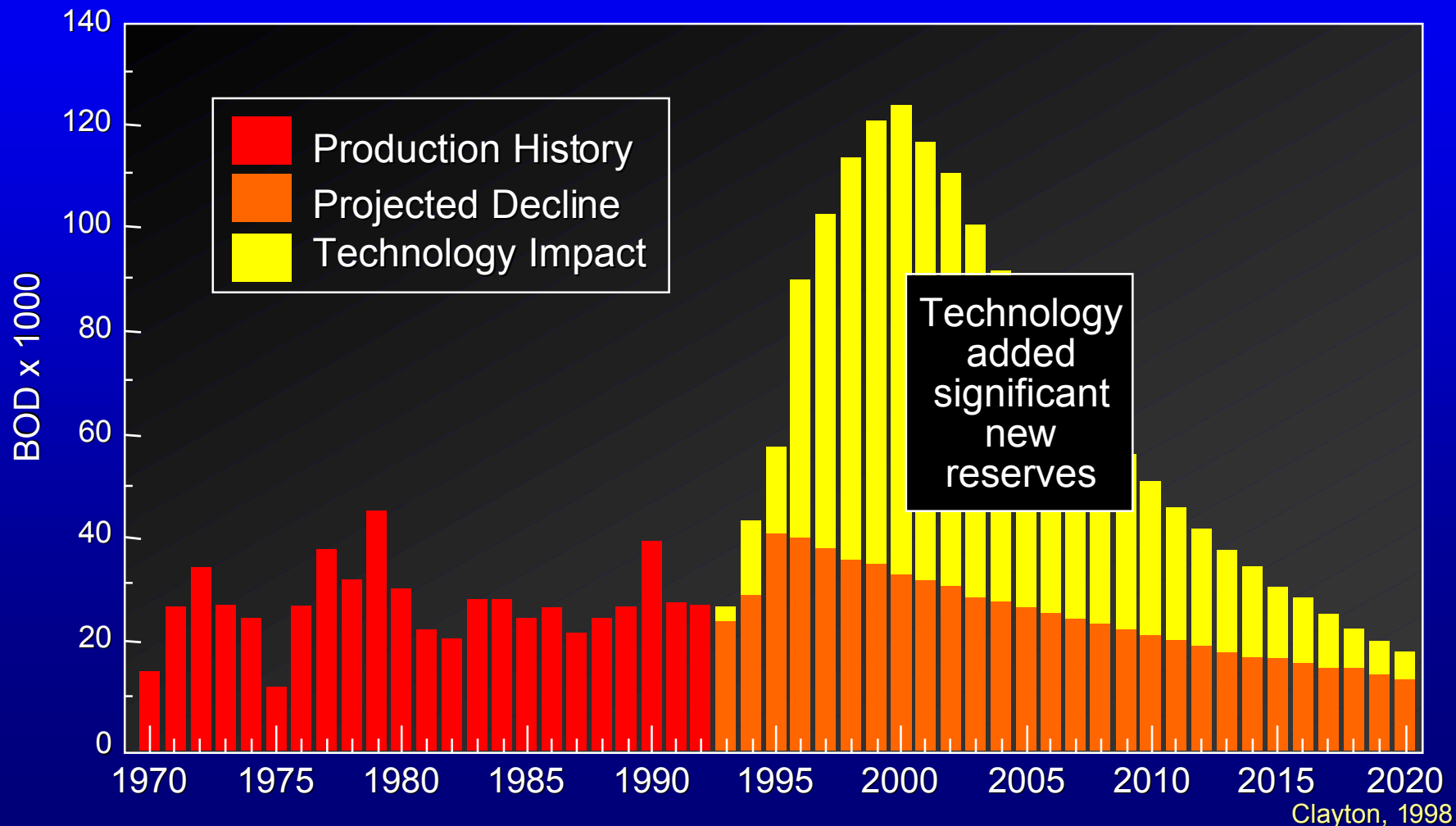
*Subject matter:
Non-applied, "esoteric"*

PRESENT REALITY: RELEVANT INTERACTIVE RESEARCH



Impact of Integrated Reservoir Management

Neogene Deltaic Reservoir



Clayton, 1998

The Importance of Developing Technologies

- New opportunities, some in old places
 - Sub-salt, sub-volcanic imaging
 - Deep water sequence stratigraphy
 - Imaging of deep structure
- Technology leads to efficiency and profitability, even at \$15/bbl
- Emphasis upon computer technology and geological skills
- Infusion of new ideas into the workforce

Future Opportunities

New Ideas

New Tools

Changed
Economics

New Discoveries
in 'Old' Areas

Job Market Expectation

By Employers

- Assume:**
- Self-motivated
 - Computer- literate
 - Well - educated
 - Team player
 - Excellent communicator

Job Market Expectation

By Employers

- Expectation:**
- **Immediate Impact**
 - **Bottom Line Focus**
 - **High Productivity**
 - **Continuous Learning**
 - **Self Reliant**

Job Market Readiness

Student Preparation

Education: • **Broadly Based**
• **Balance of Theory
and Application**

Thesis: • **Targeted**

Job Market Readiness

Student Preparation

- Skills:**
- Think 4-D
 - Computer Workstation
 - English Proficiency

- Traits:**
- Self-motivated
 - Proactive

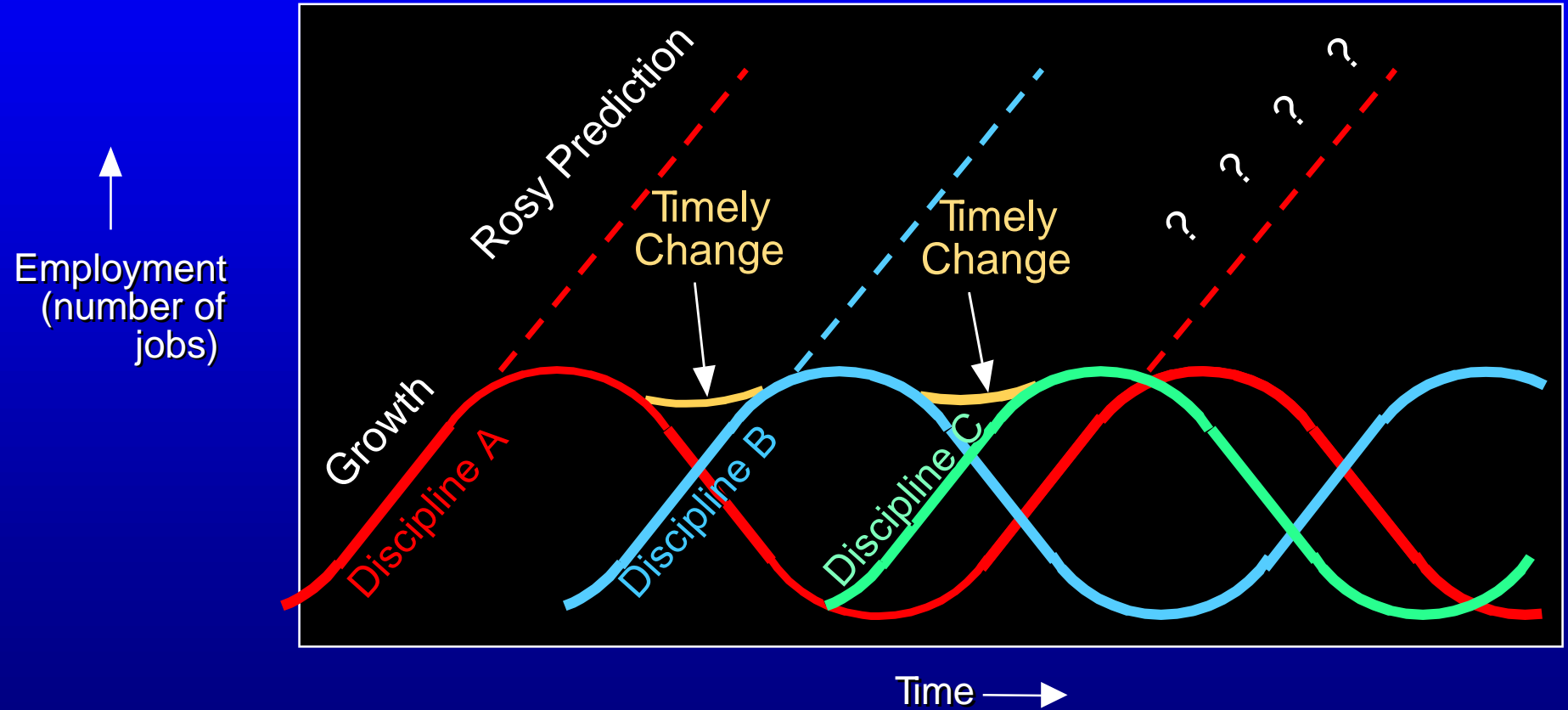
Petroleum Industry Careers

Survival Training

- Strong basic-discipline training
- Competitive-edge in several skills
 - Quantitative (space & time)
 - Workstation (computer)
 - Interpersonal
 - English Language
- Excellent communication skills
 - Oral, written, graphical
- Constant updating / expansion of skills

Cyclic Job Market

Continuous Learning Facilitates Timely Changes



Professional Societies



Local Societies
GSM, IPA, etc



**Technology
Disseminators**

The Future for the Oil Industry

- Dominant fuel source for 30-60 more years
- Increased emphasis on enhanced recovery/production scale sedimentology/3-D visualisation/cross-disciplinary communication
- Higher efficiency demands high workstation skill levels as well as competency in fundamentals
- People provide the competitive edge (because everyone has the same tools)

Jobs for the best engineers / geoscientists

The Future....

