

**OIL DEPLETION - DEALING WITH THE ISSUES**  
**Modelling the oil supply gap**

**for THE ENERGY INSTITUTE (NOVEMBER 2006)**  
**Dr Michael R. Smith, Chief Executive, Energyfiles**

# Discussion points

- A simple supply model
- The size of the oil supply gap?
- “Filling” the gap
- “Closing” the gap

# A SIMPLE MODEL



# A SIMPLE MODEL

## Any sedimentary basin

First fields discovered are large and easy to find

Later fields get progressively smaller

Come onstream within 3 or 4 years of discovery

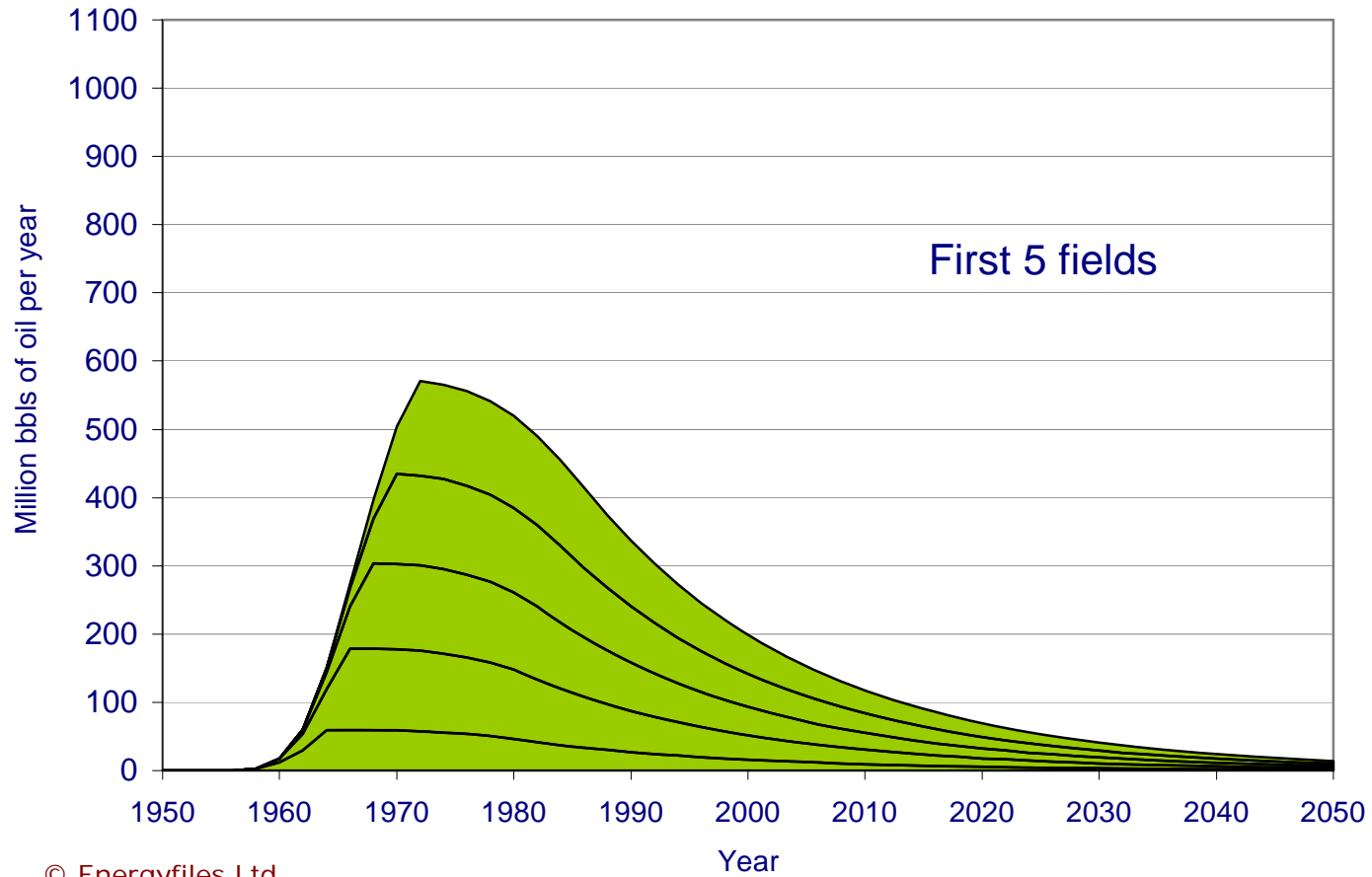
Have a characteristic production profile set by:

- reservoir characteristics (poroperm, etc.)
- fluid type (oil, gas, viscosity, etc.)
- pressure, temperature
- environment of production (on/offshore, the market)
- investment level, timing and special events

Output for each field

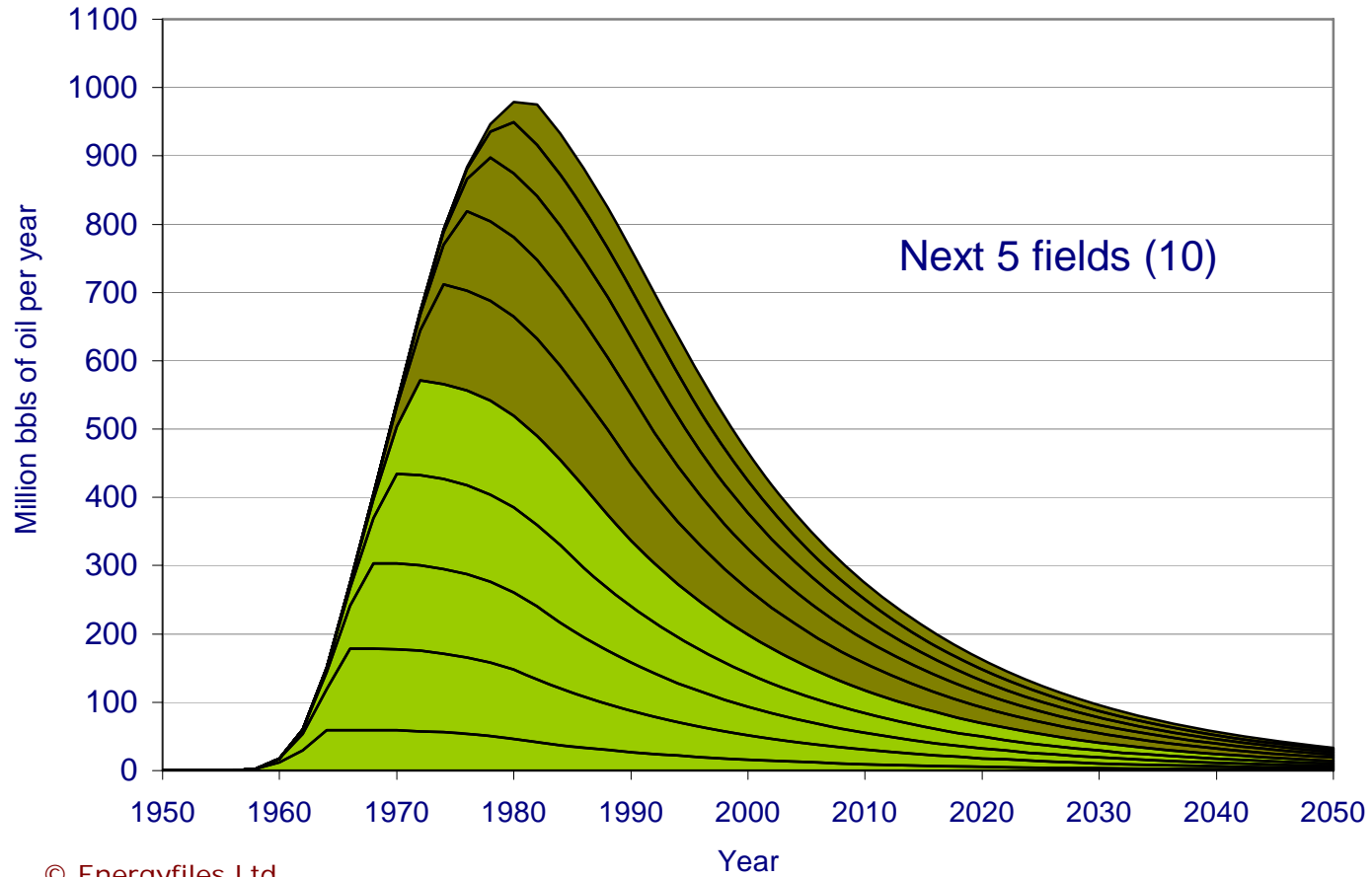
- rises to a plateau in 2 or 3 years
- stays at plateau for 2 or 3 years
- large fields plateau longer
- offshore fields plateau shorter
- declines at 5% to 15% depending on characteristics

### HYPOTHETICAL: MODEL OIL PRODUCTION FORECAST



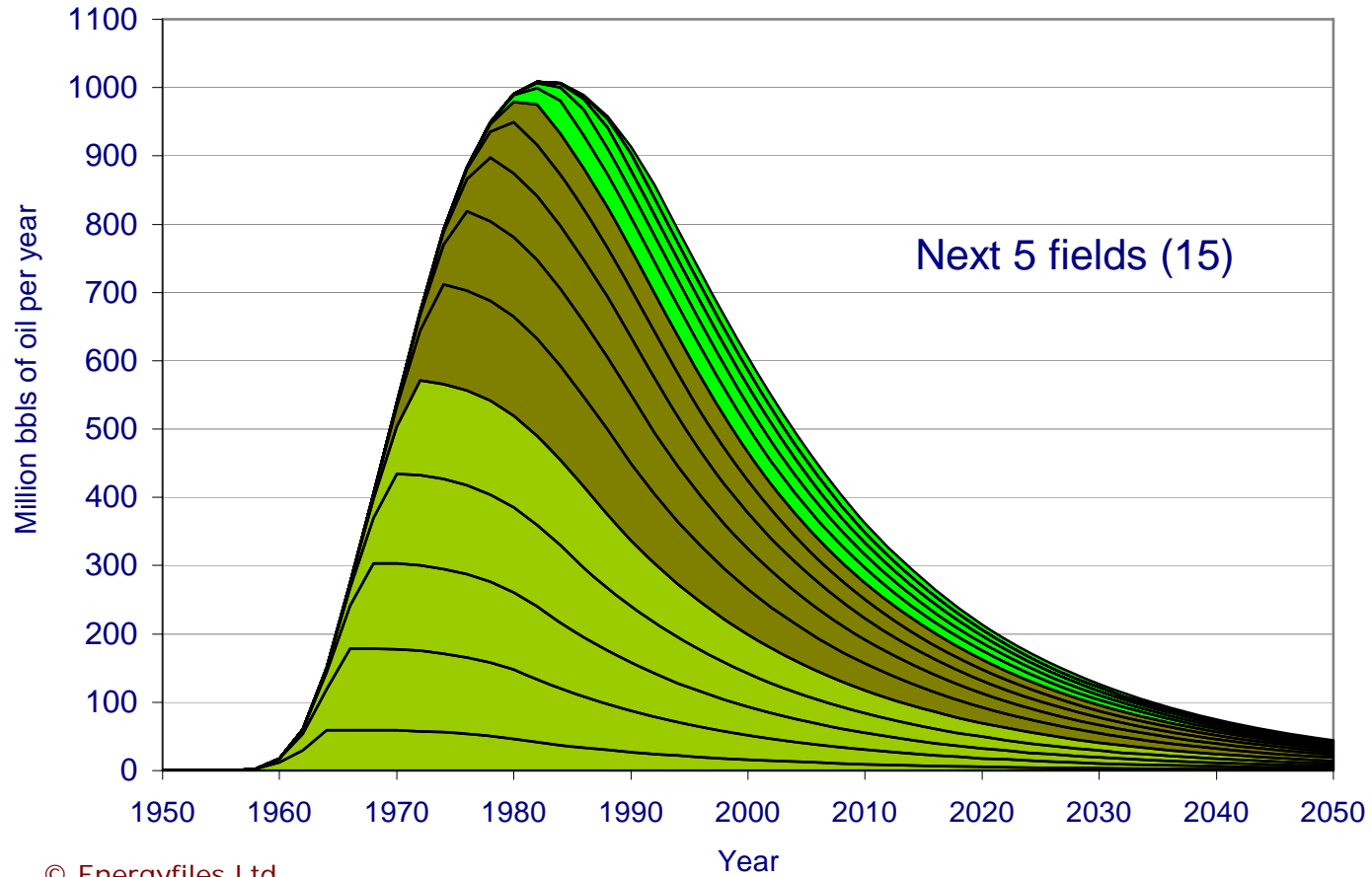
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### HYPOTHETICAL: MODEL OIL PRODUCTION FORECAST



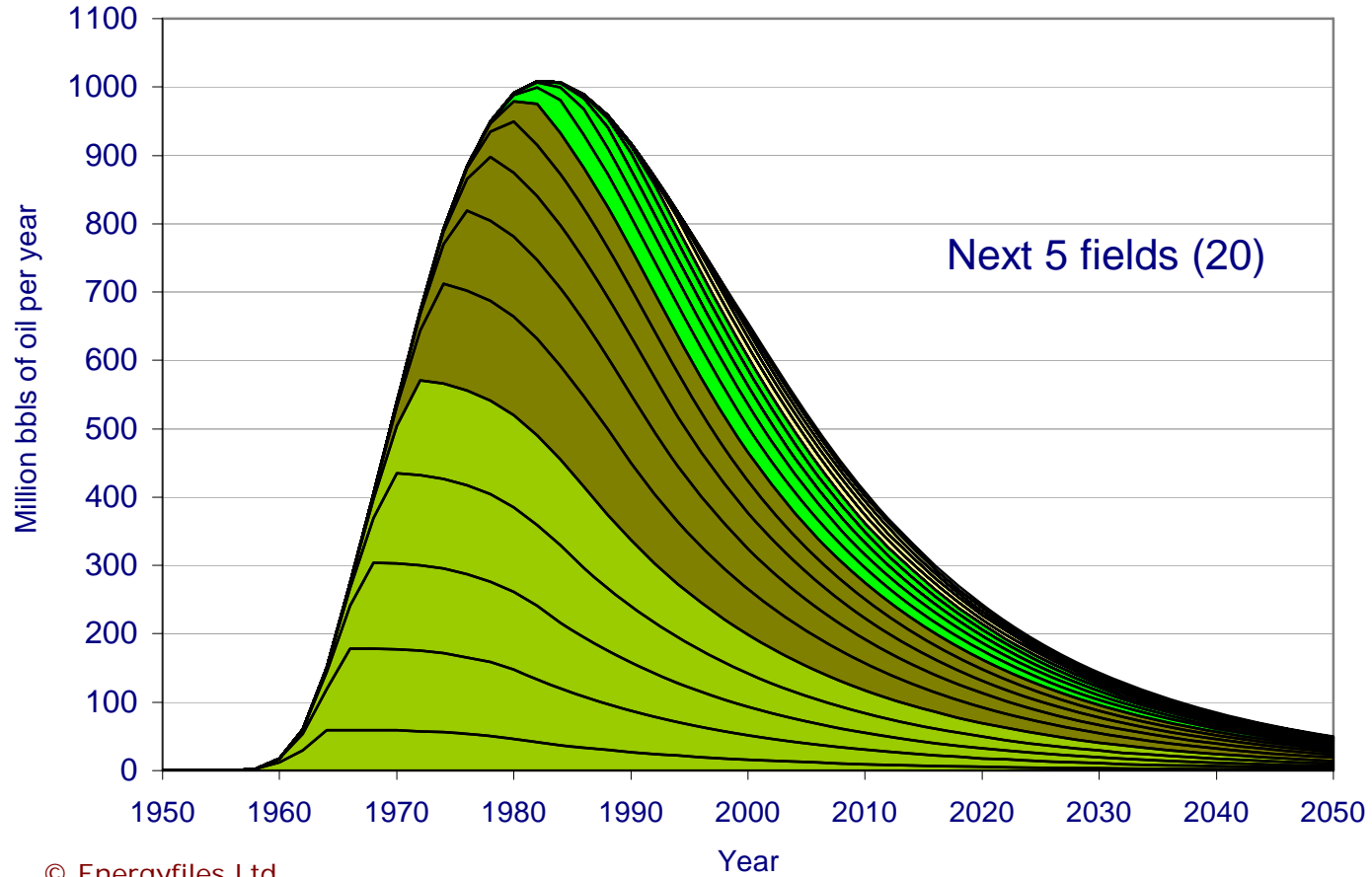
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### HYPOTHETICAL: MODEL OIL PRODUCTION FORECAST



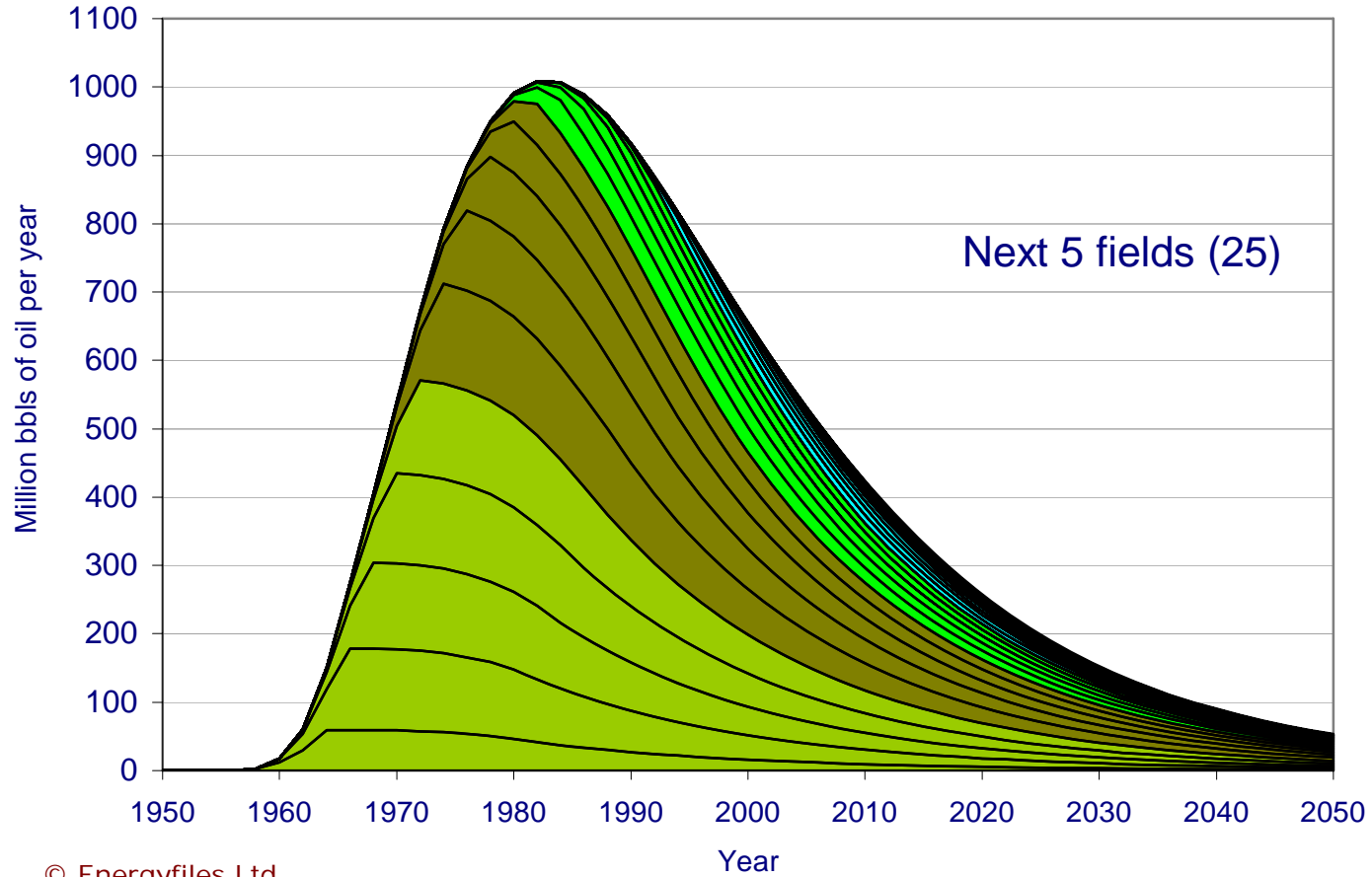
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### HYPOTHETICAL: MODEL OIL PRODUCTION FORECAST



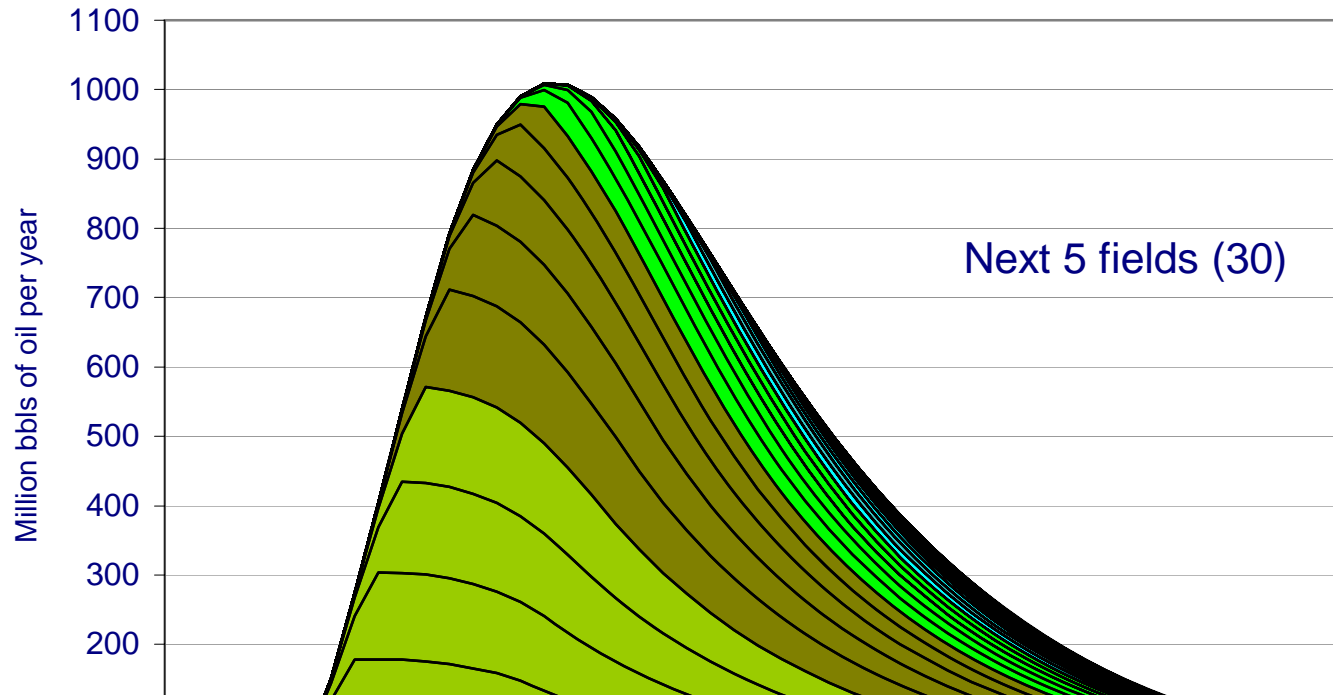
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### HYPOTHETICAL: MODEL OIL PRODUCTION FORECAST

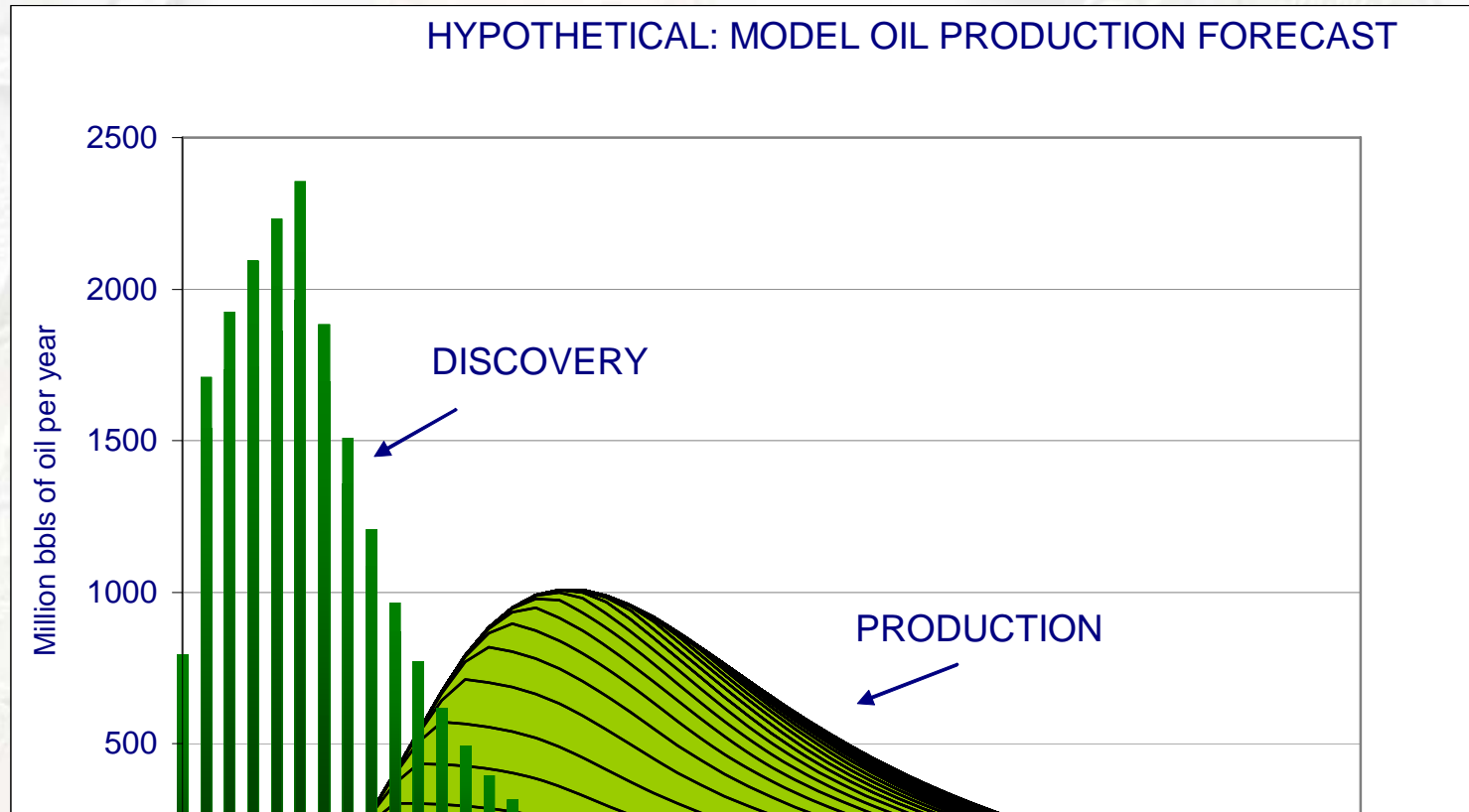


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### HYPOTHETICAL: MODEL OIL PRODUCTION FORECAST



Later fields do not affect peak; they slow decline  
After peak technology can also only slow decline



Production peak lags discovery peak by ~ 25 years

Discovery peak is a signal

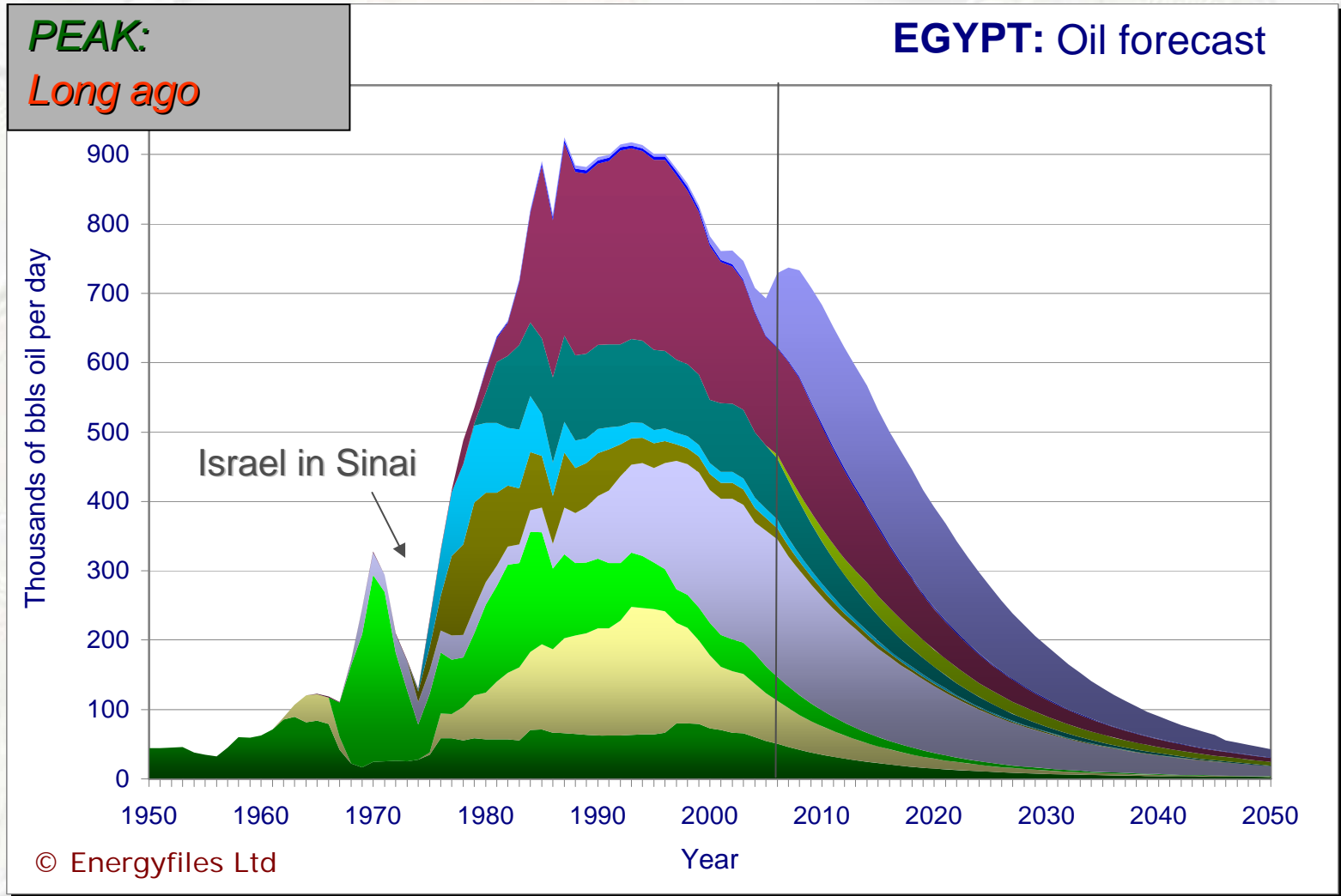
# SUMMARISE REAL WORLD MODELLING

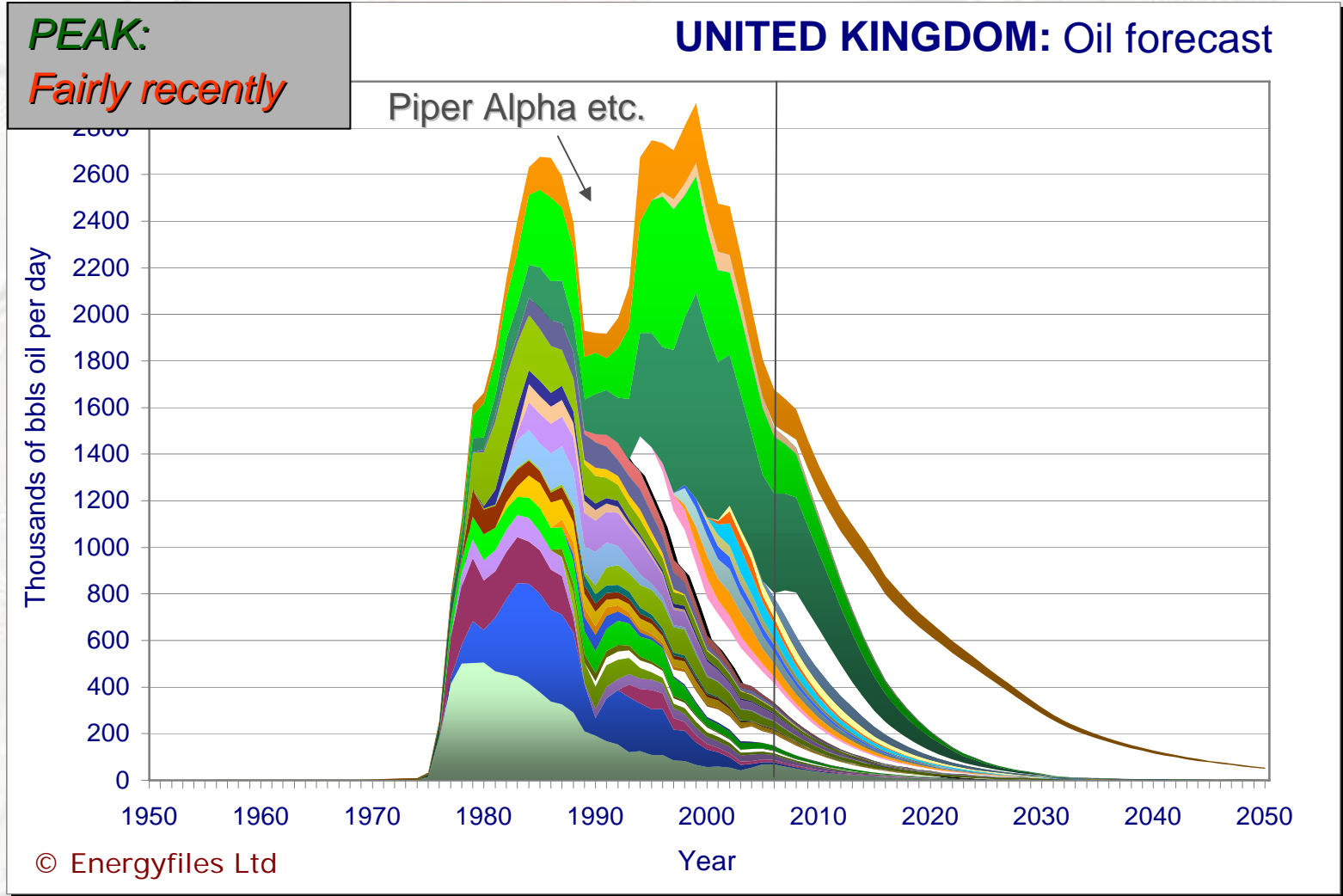
## Countries past peak (~64):

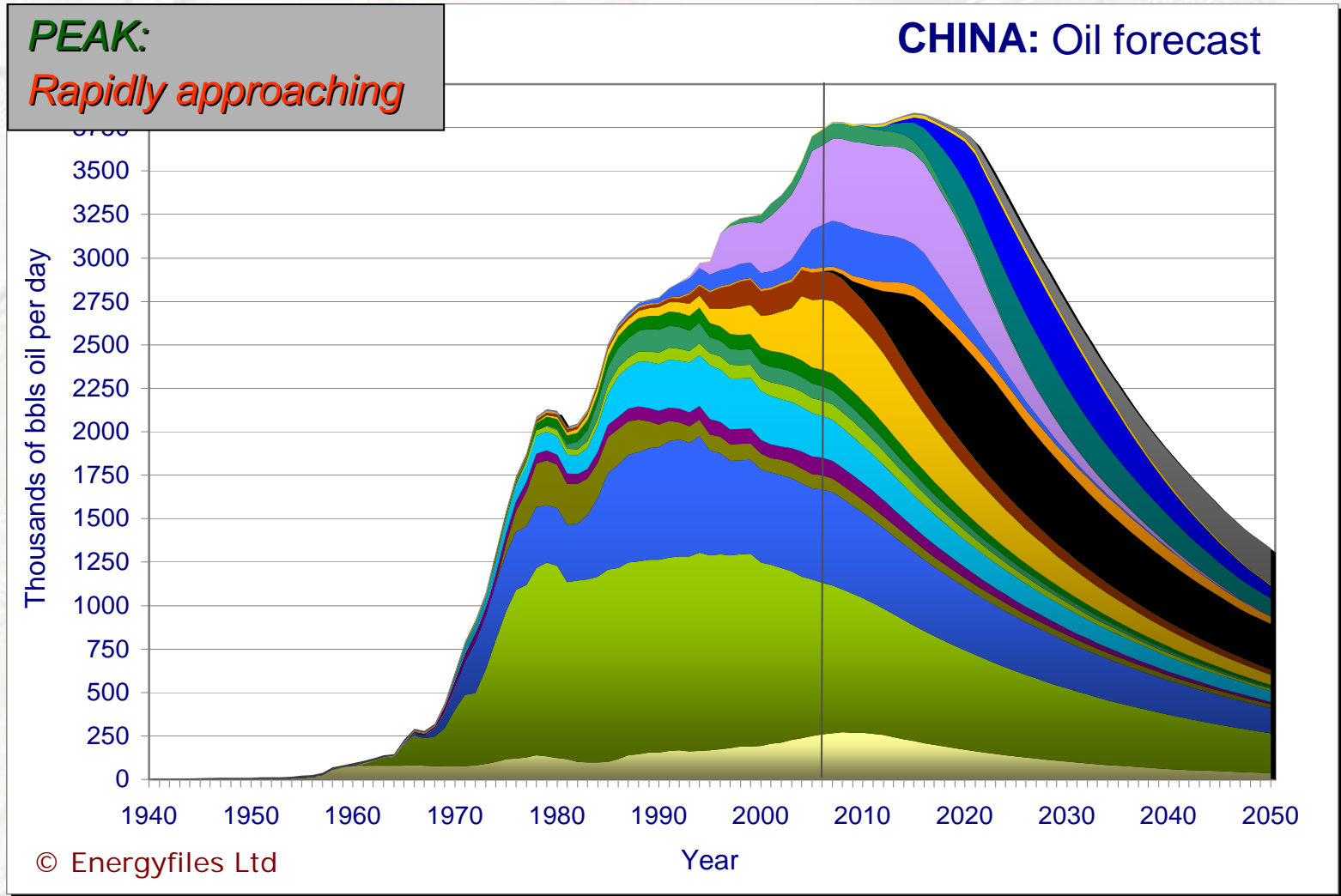
- Analyse basins (plays) individually
- If possible look at every field production profile
- Define individual and group decline rates
- Assess yet-to-develop (YTD) and yet-to-find (YTF) including through EOR using cumulative plots and geological knowledge

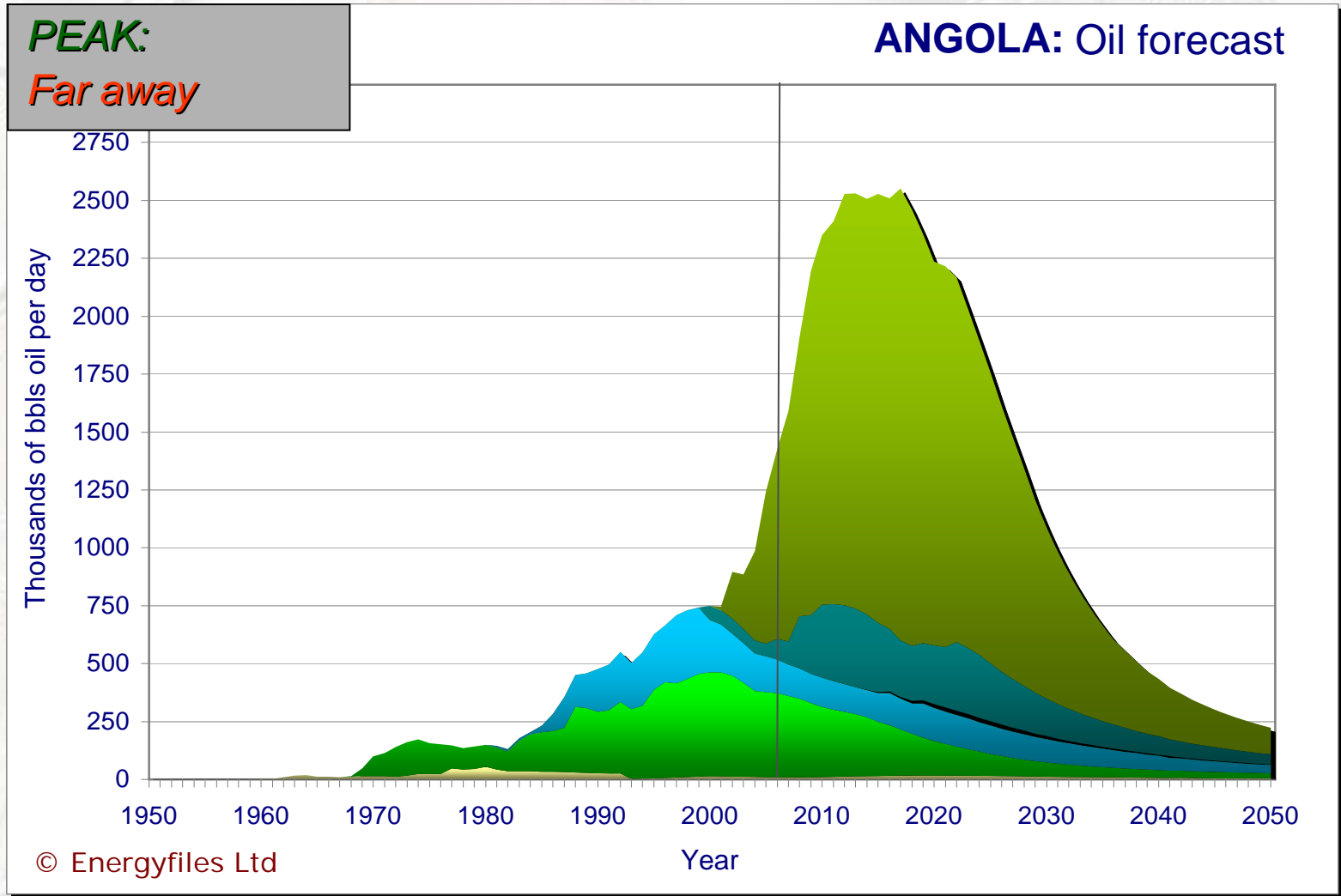
## Countries pre-peak (~36):

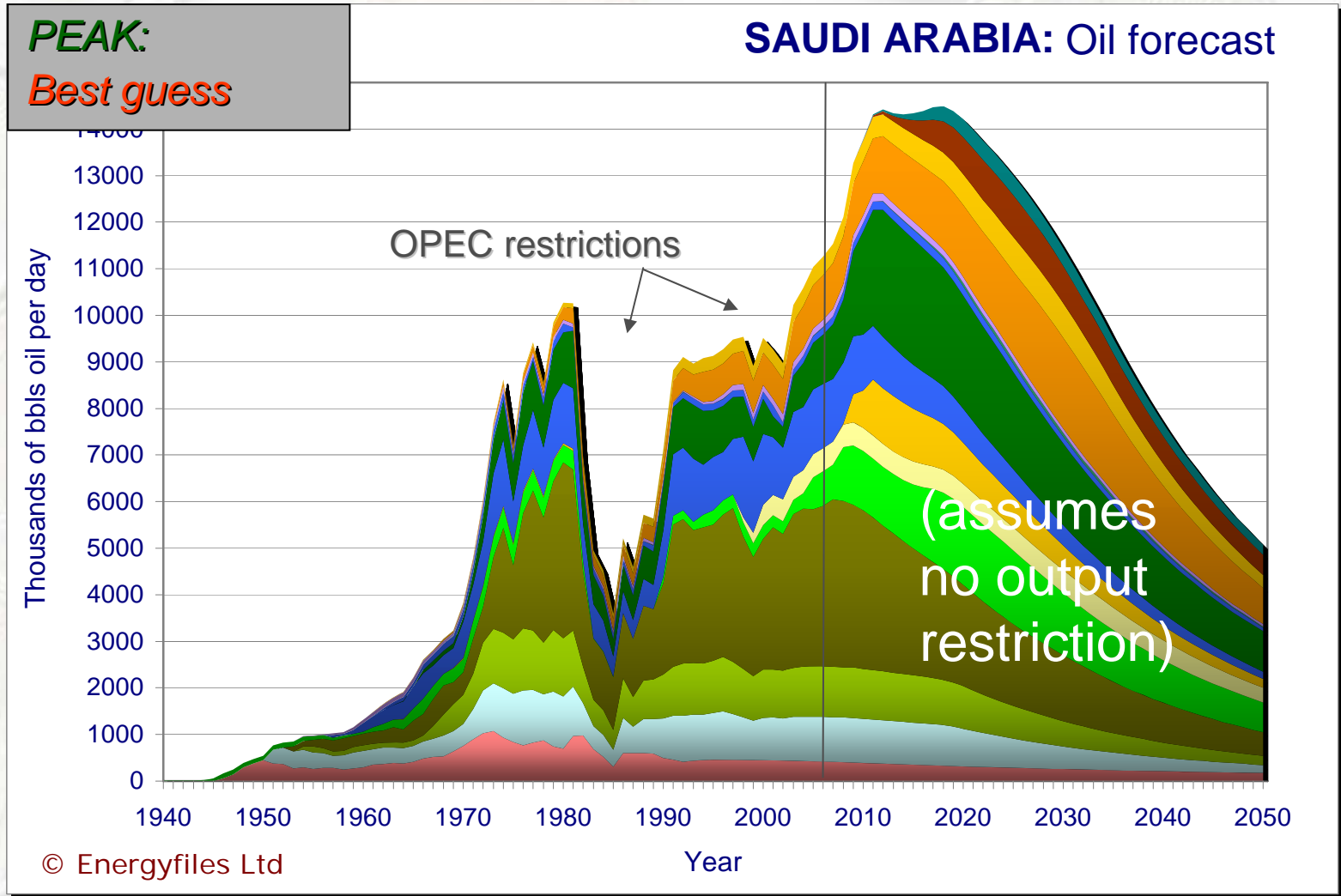
- Discoveries are a signal (~25 years pre-production peak)
- Individual fields already past peak indicate decline rates
- Cumulative plots/geology give idea of YTD and YTF
- Must review special histories (e.g. OPEC restriction)









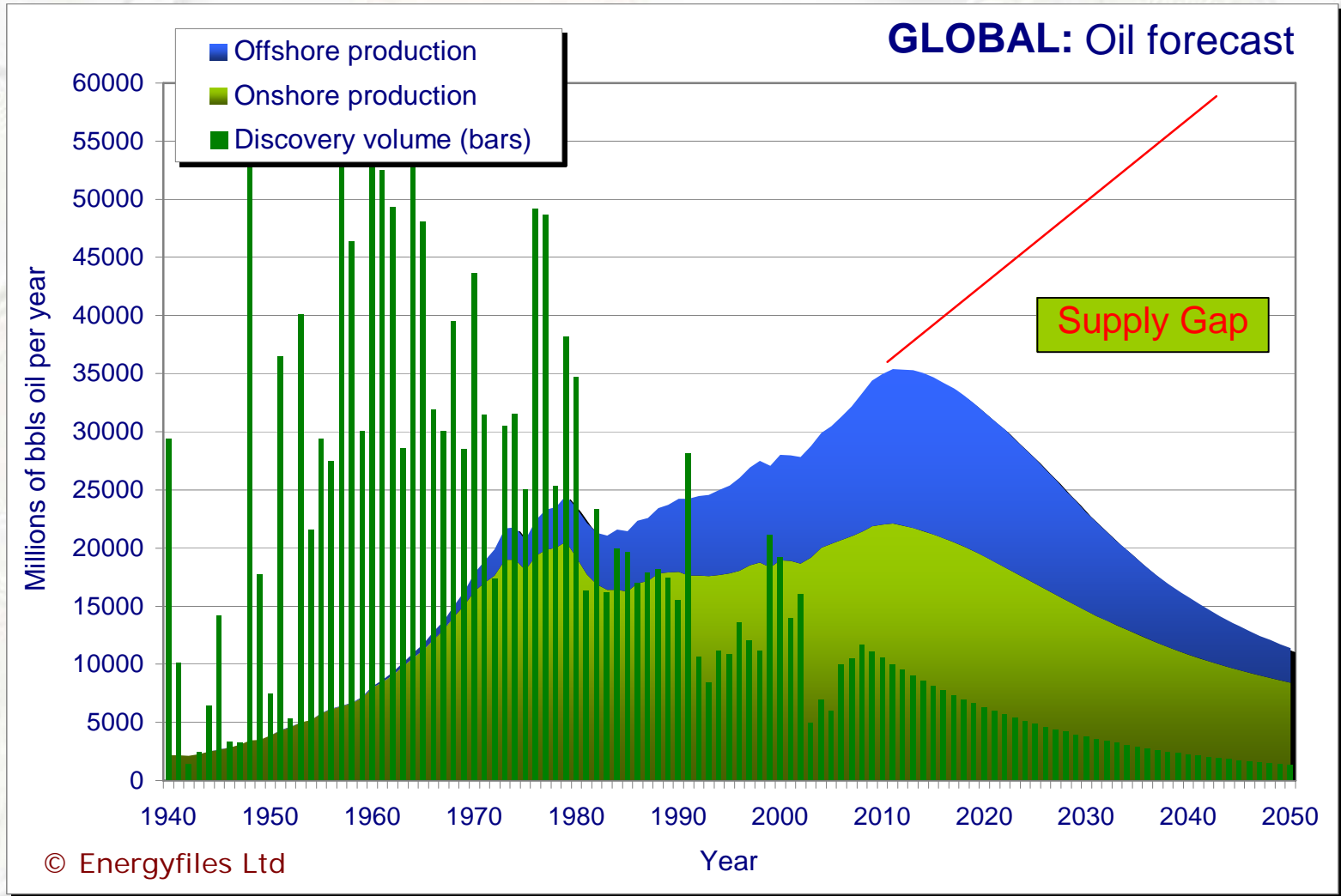


# THE SIZE OF THE OIL SUPPLY GAP?



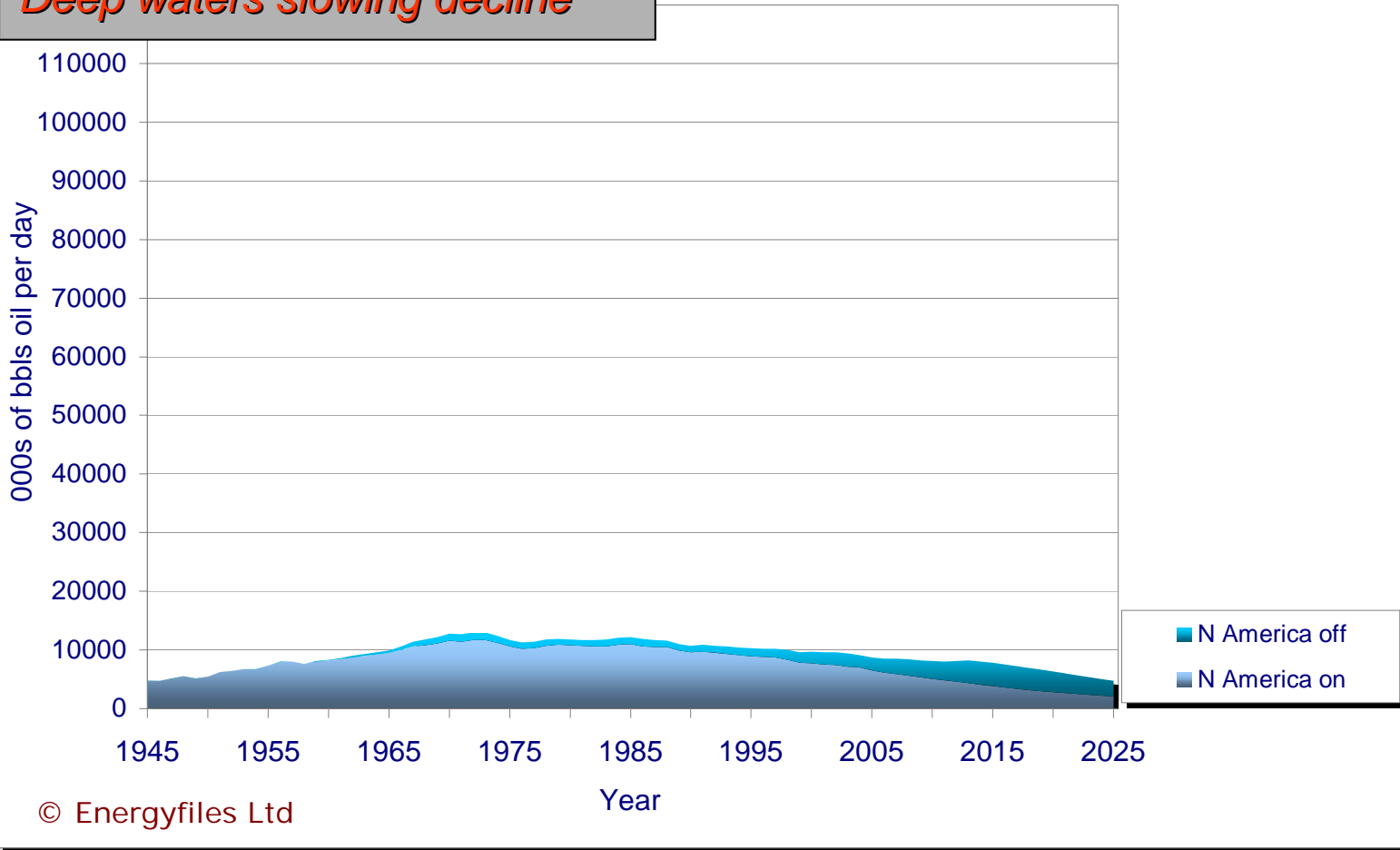
Bangkok, Thailand

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**NORTH AMERICA:**  
*Deep waters slowing decline*

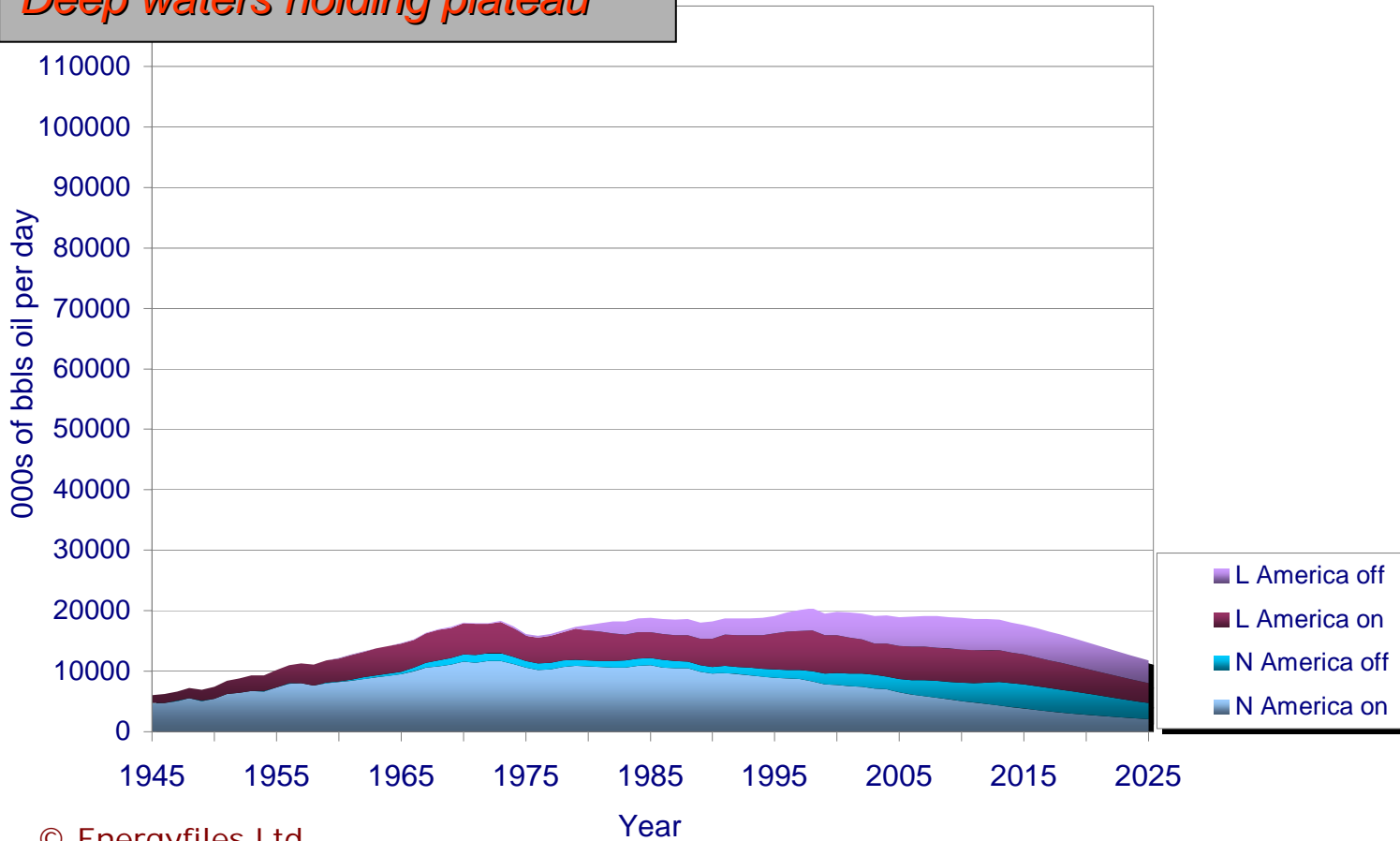
**GLOBAL: Oil forecast (regions)**



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**LATIN AMERICA:**  
*Deep waters holding plateau*

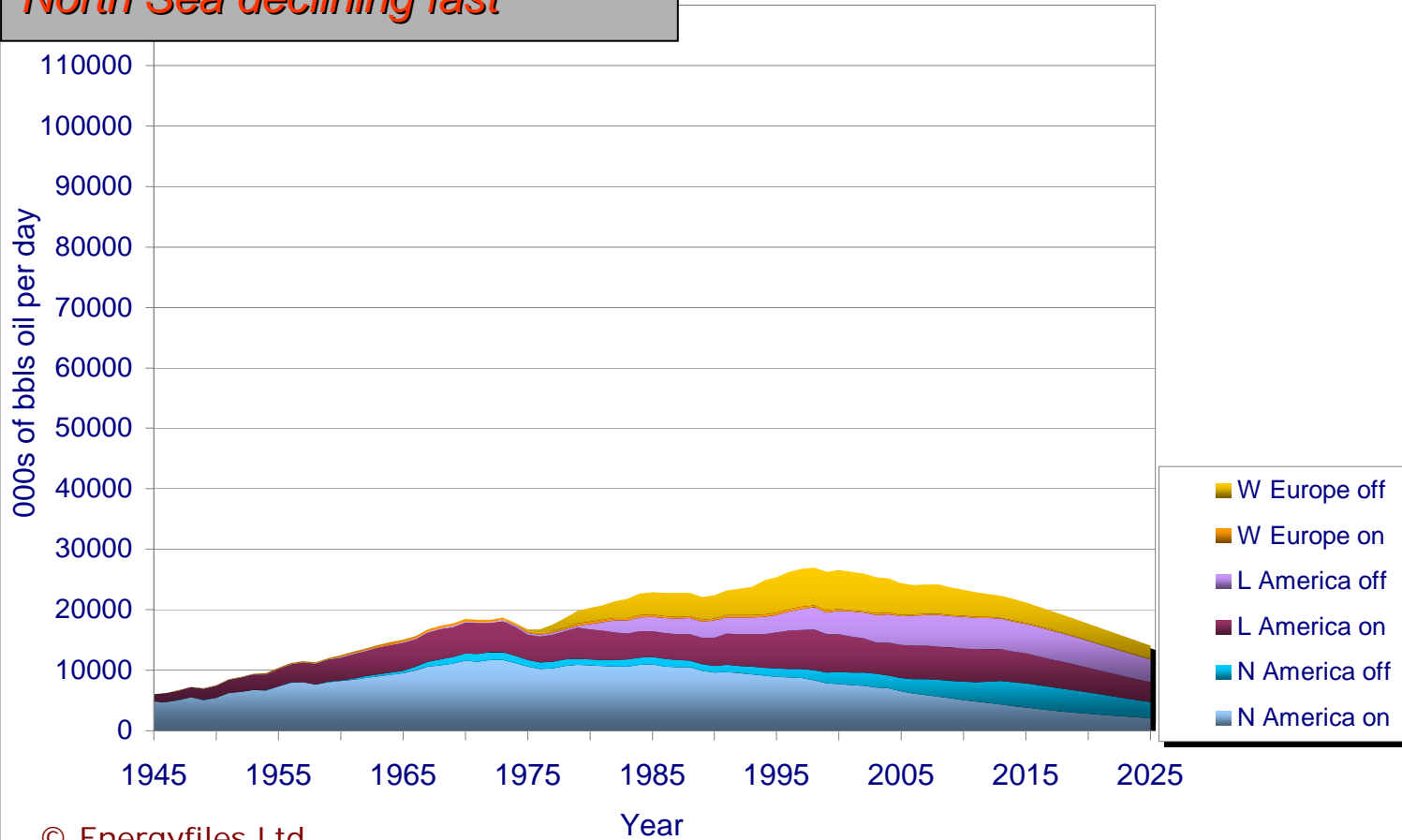
**GLOBAL: Oil forecast (regions)**



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**WESTERN EUROPE:**  
*North Sea declining fast*

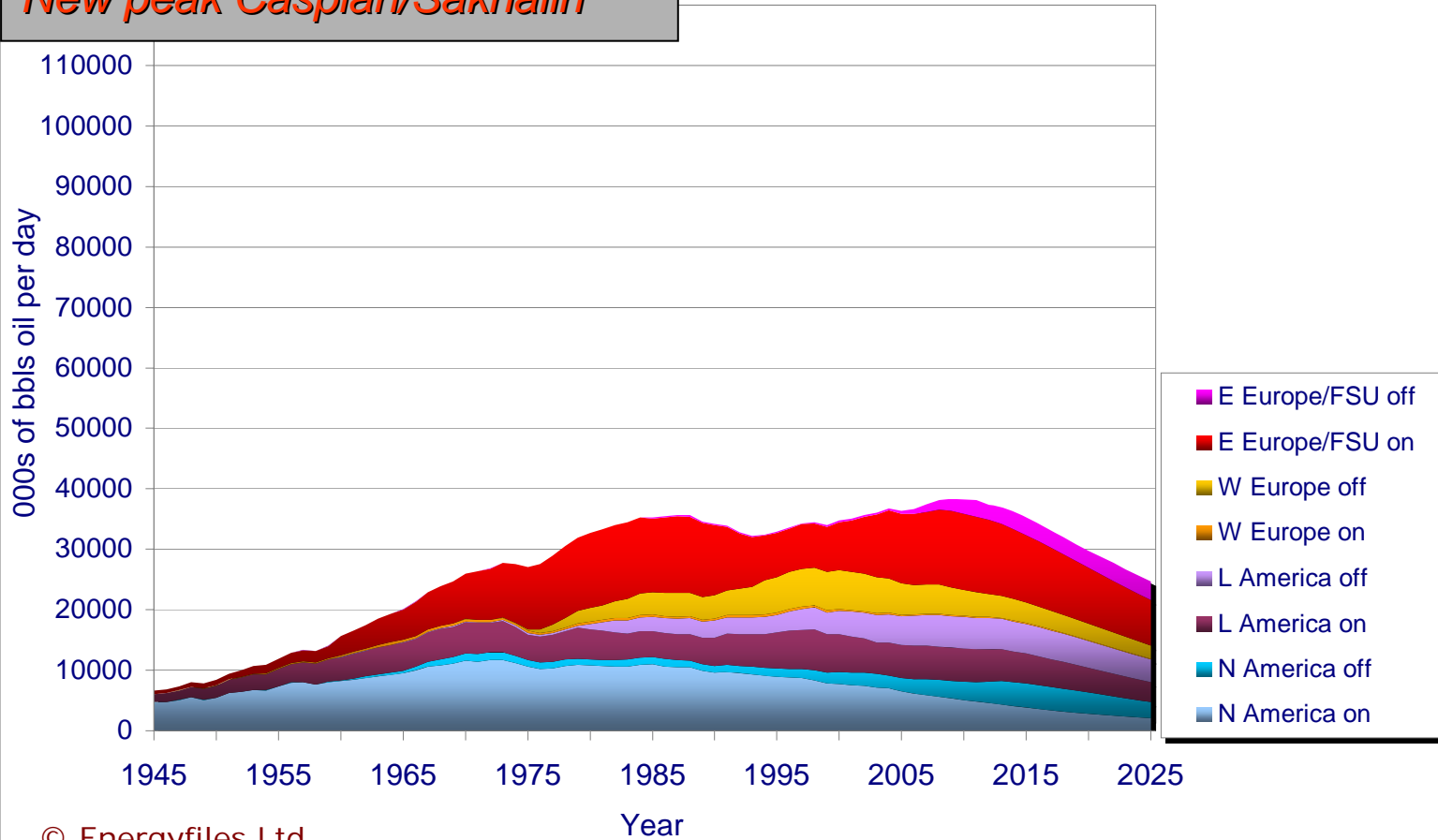
**GLOBAL:** Oil forecast (regions)



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**EASTERN EUROPE & FSU:**  
*New peak Caspian/Sakhalin*

**GLOBAL: Oil forecast (regions)**

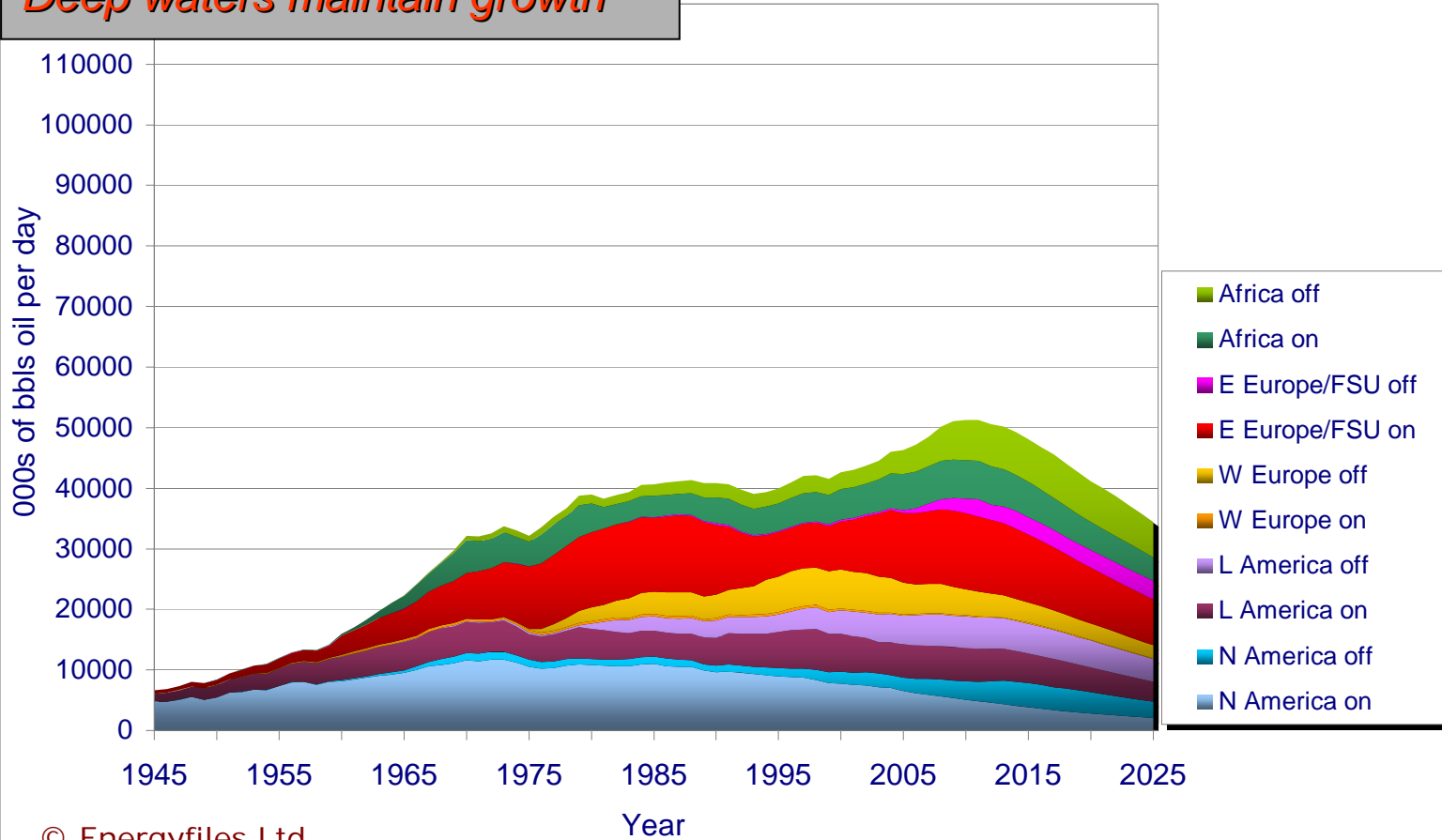


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**AFRICA:**

*Deep waters maintain growth*

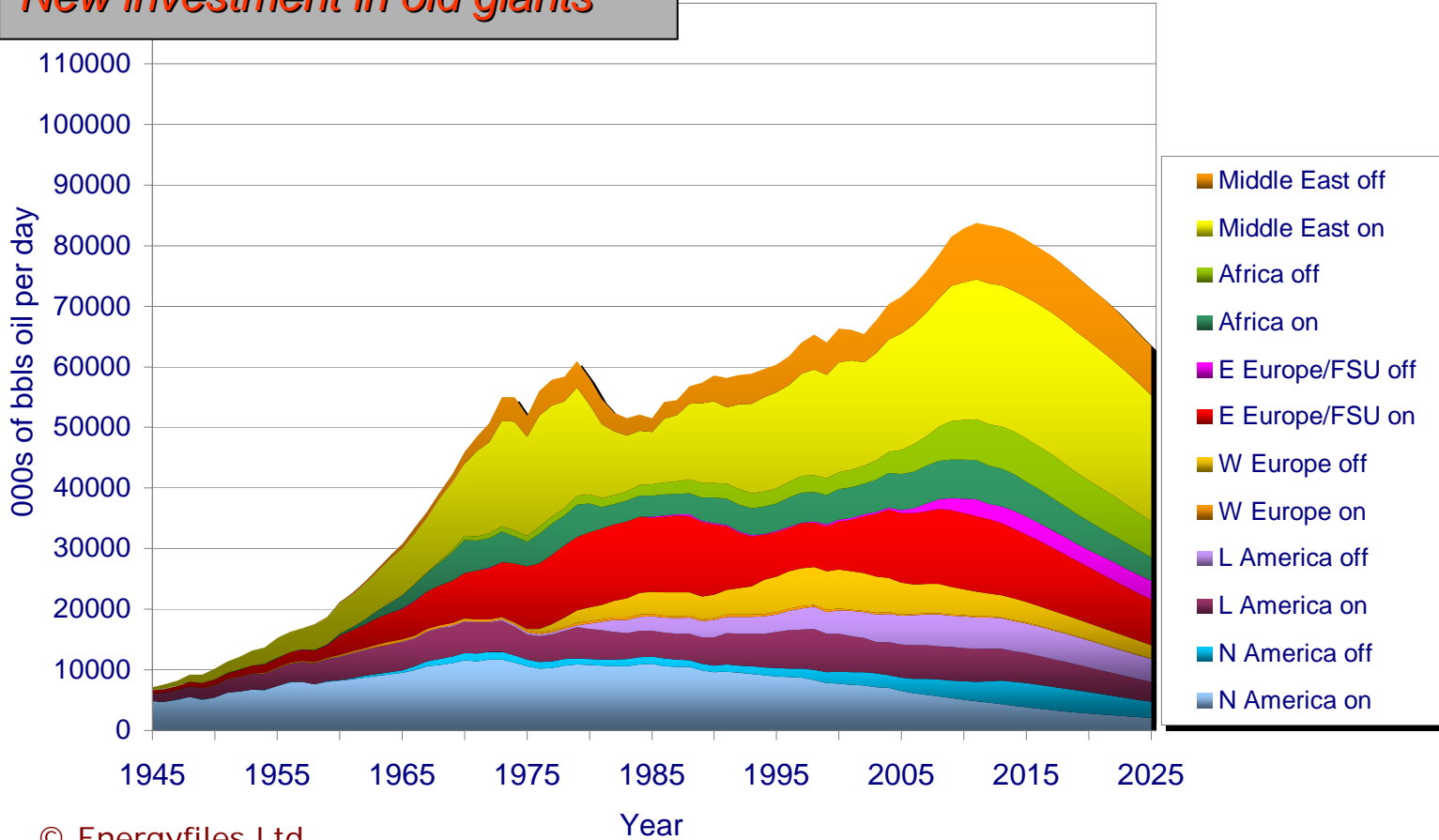
**GLOBAL: Oil forecast (regions)**



**MIDDLE EAST:**

*New investment in old giants*

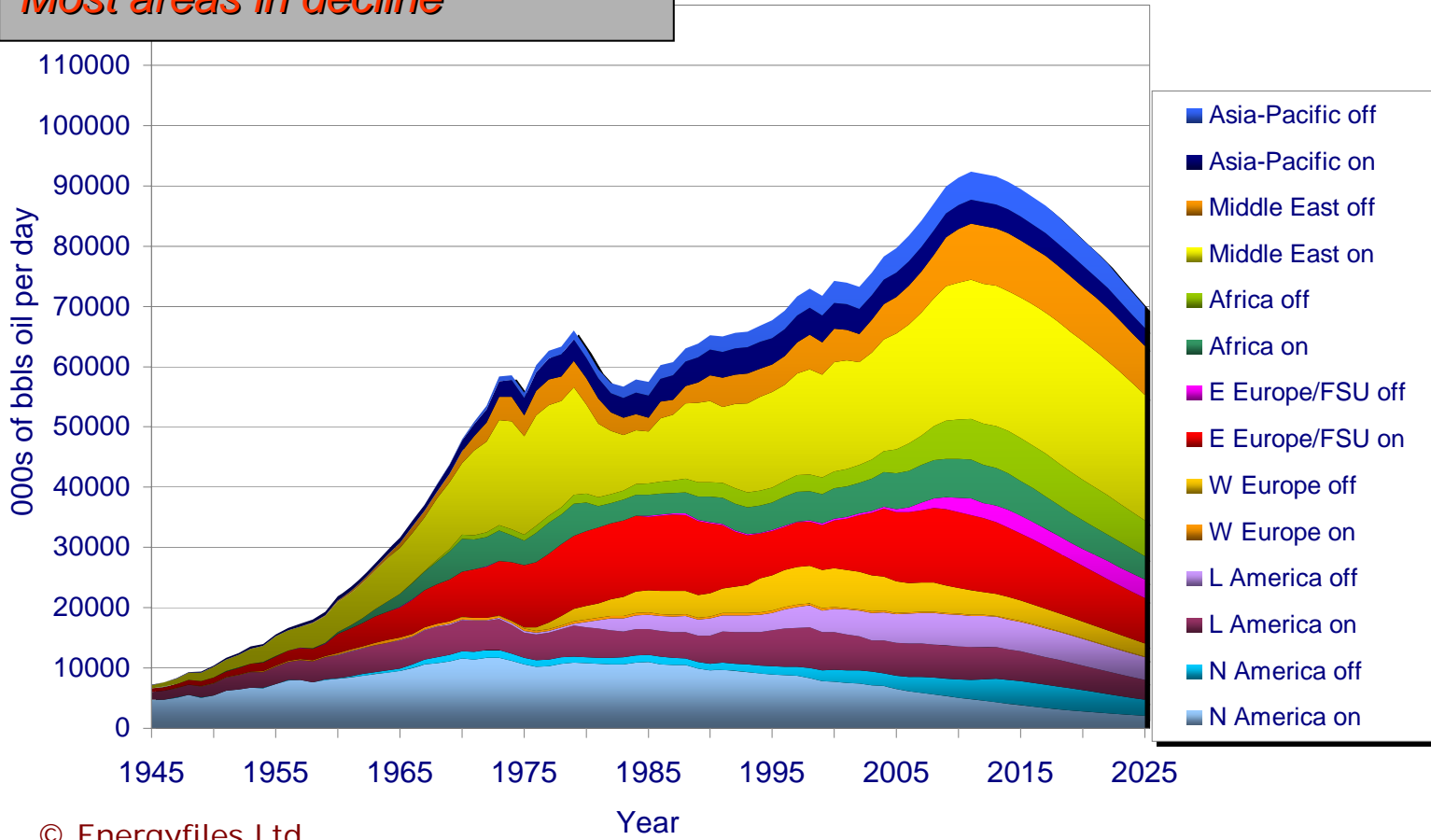
**GLOBAL: Oil forecast (regions)**



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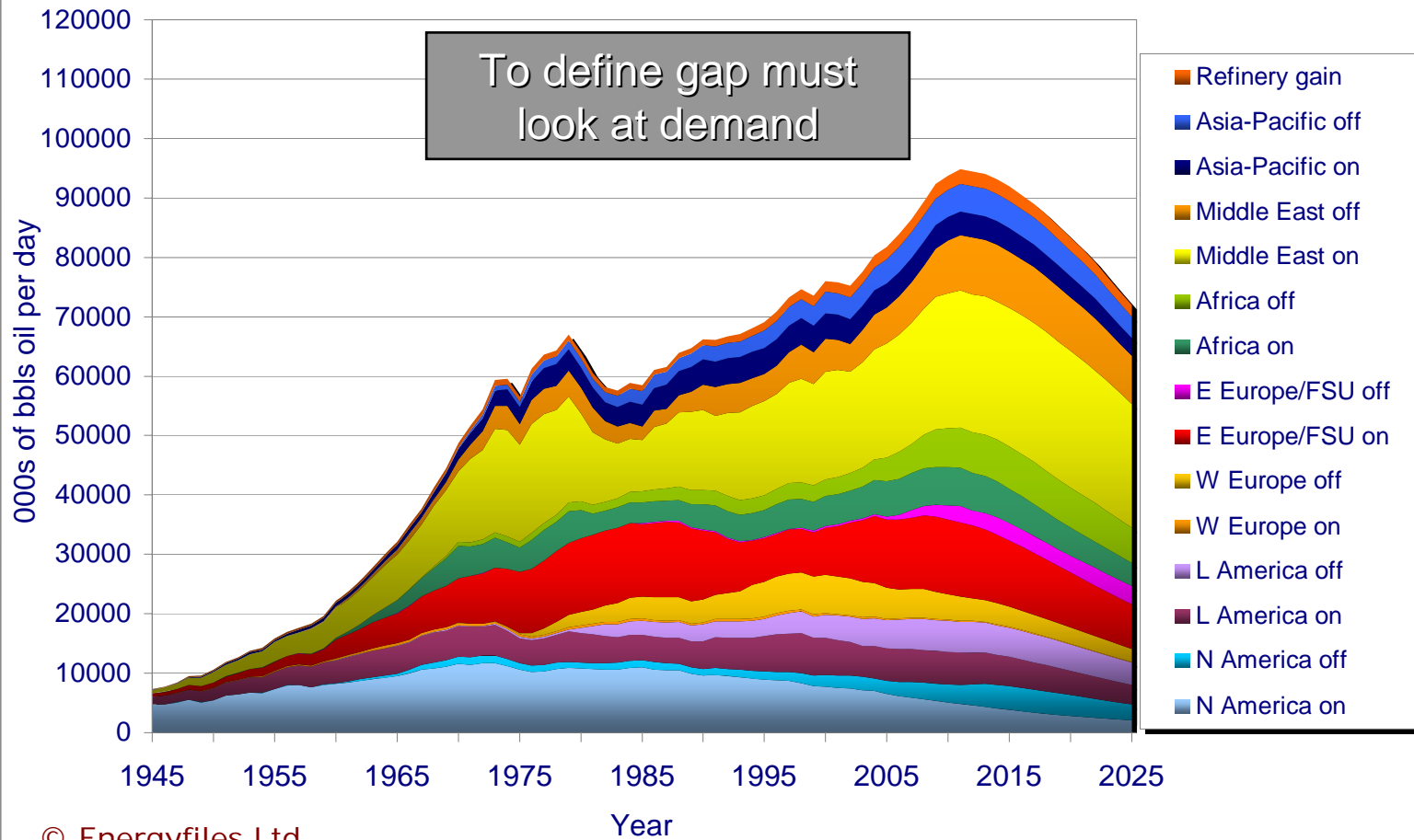
**ASIA-PACIFIC:**  
*Most areas in decline*

**GLOBAL: Oil forecast (regions)**

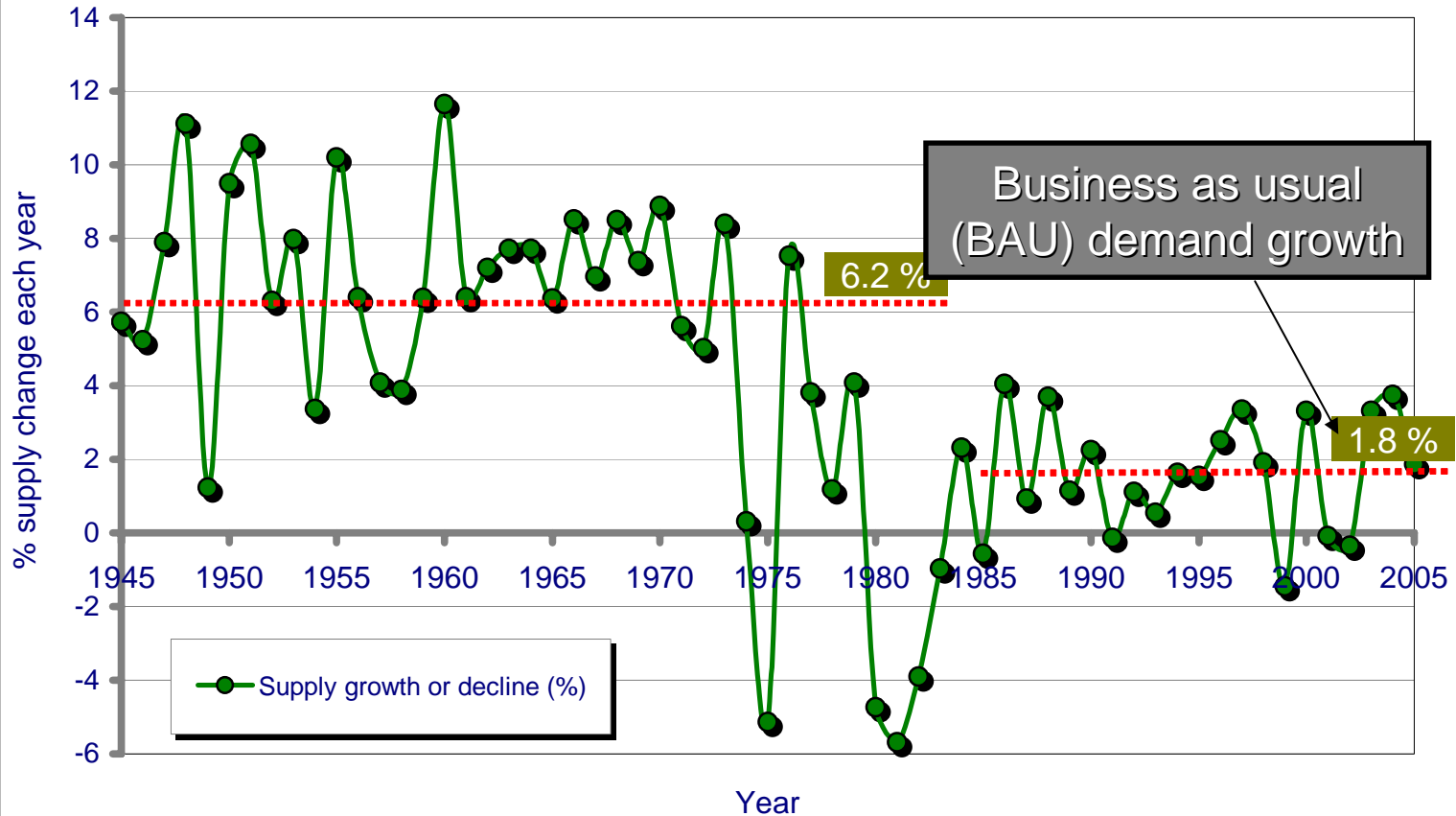


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## GLOBAL: Oil forecast (regions)

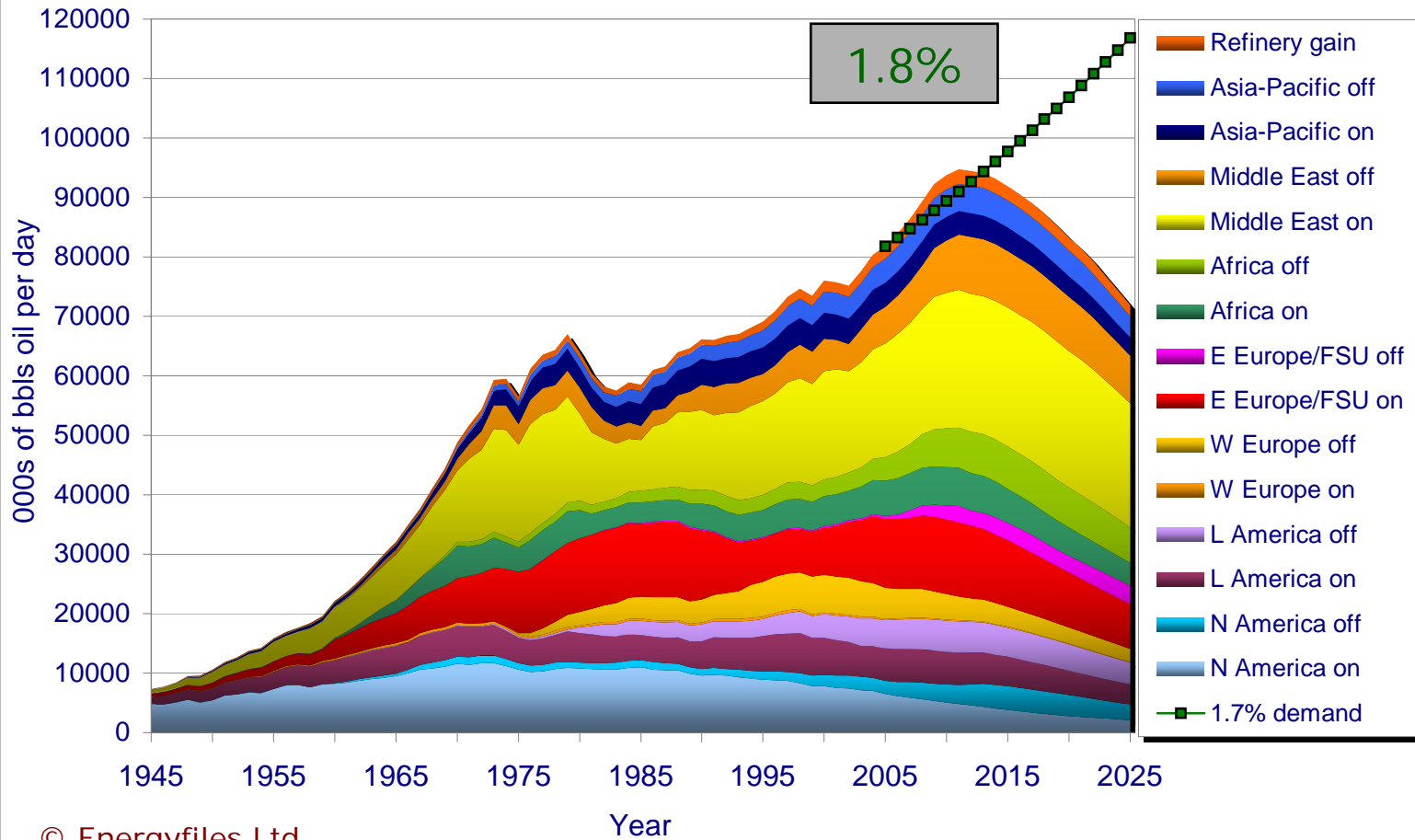


## GLOBAL: Historic supply changes

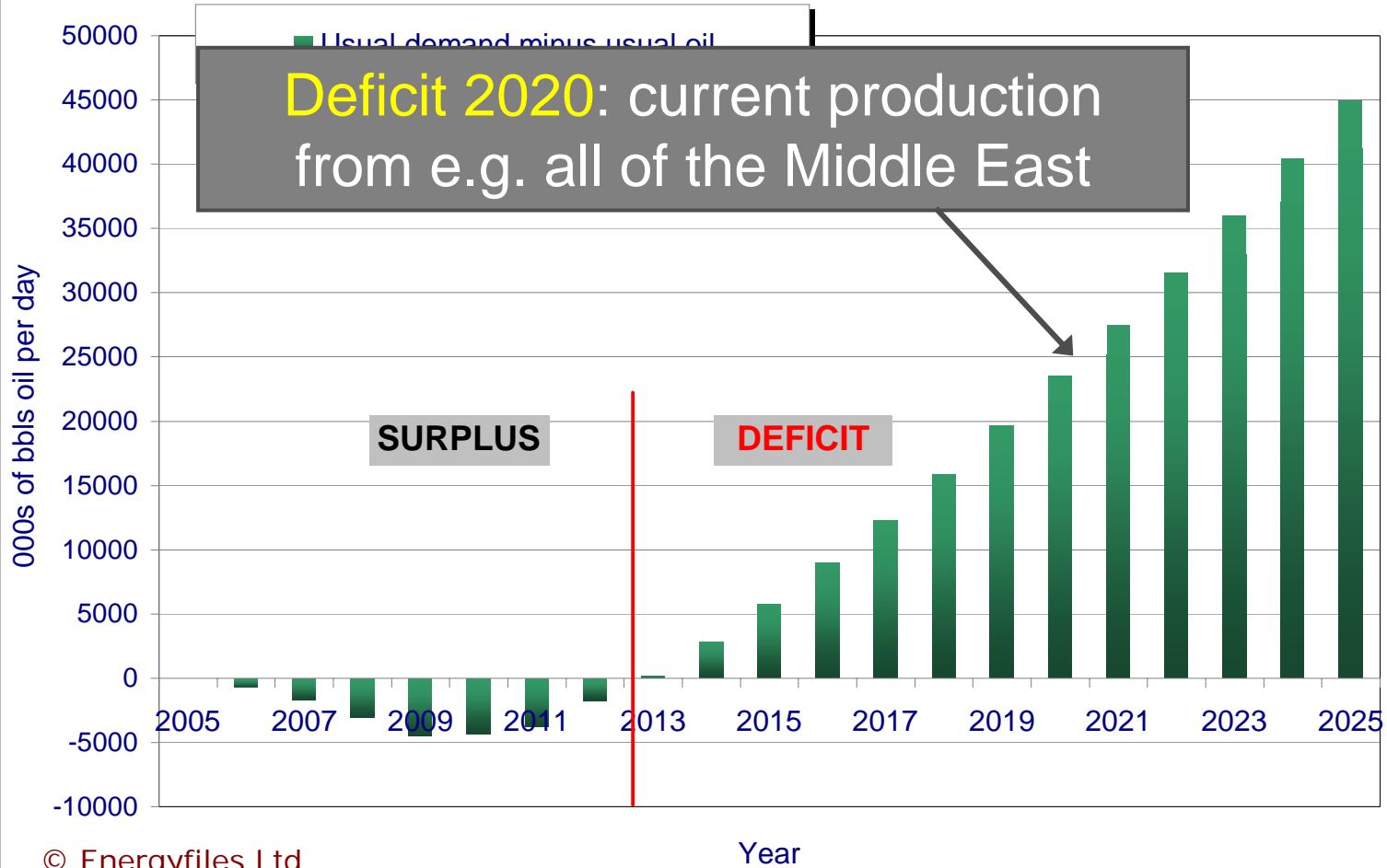


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## GLOBAL: Usual oil forecast (regions)



## GLOBAL: Oil shortfall



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# FILLING THE OIL SUPPLY GAP

(with alternative oils)



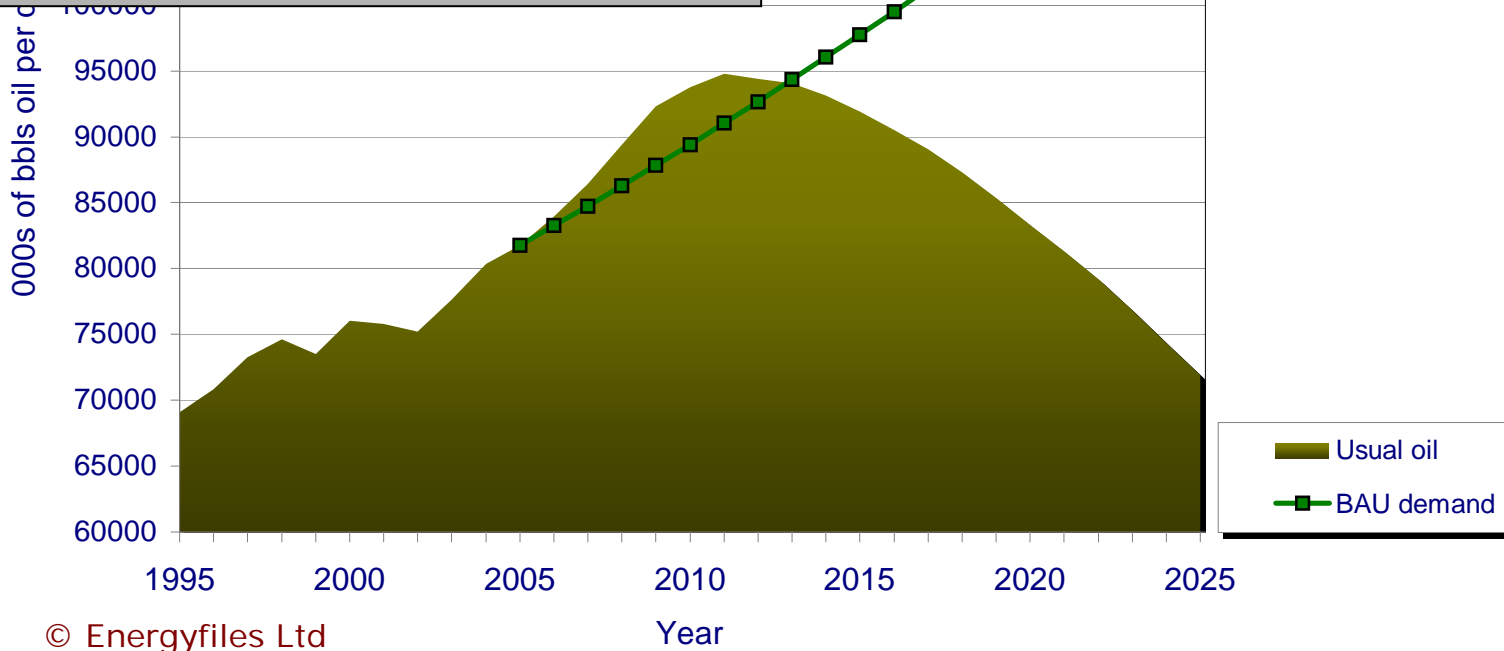
Drake well, Pennsylvania  
© Energyfiles Ltd

### CANADA (ATHABASCA)

*"...Canada's greatest buried energy treasure...could satisfy the world's demand for petroleum for the next century."*

**TIME MAGAZINE, 2005**

### GLOBAL: Oil forecast (detail)



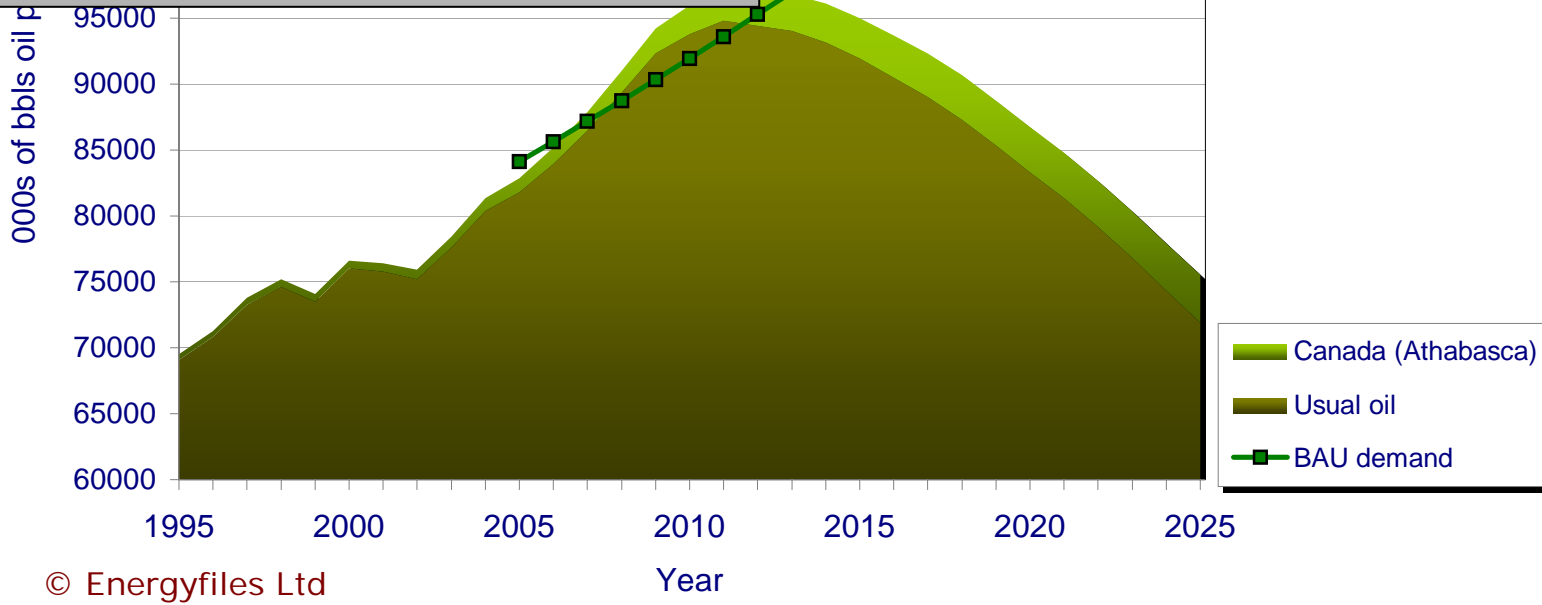
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### VENEZUELA (LA FAJA)

*"...huge amounts of extra-heavy oil will become available and, with prices not lower than US\$30 a barrel, Venezuela will reap a great bonanza."*

**ENERGY BULLETIN, 2004**

### GLOBAL: Oil forecast (detail)



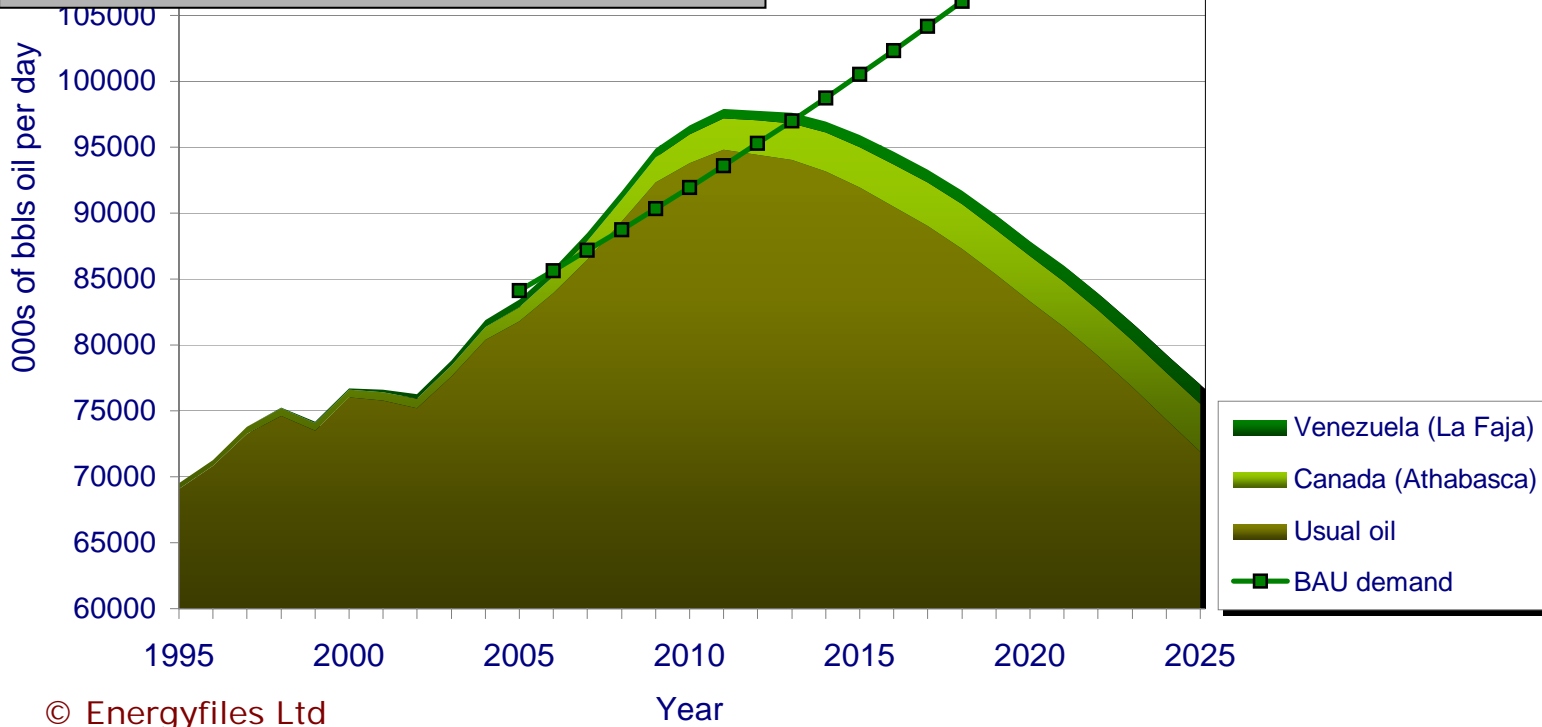
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### OTHER OIL SANDS

*"...The deposits are found in 30 countries and in 54 different geological basins,"*

**WORLD ENERGY COUNCIL, 2000**

### GLOBAL: Oil forecast (detail)



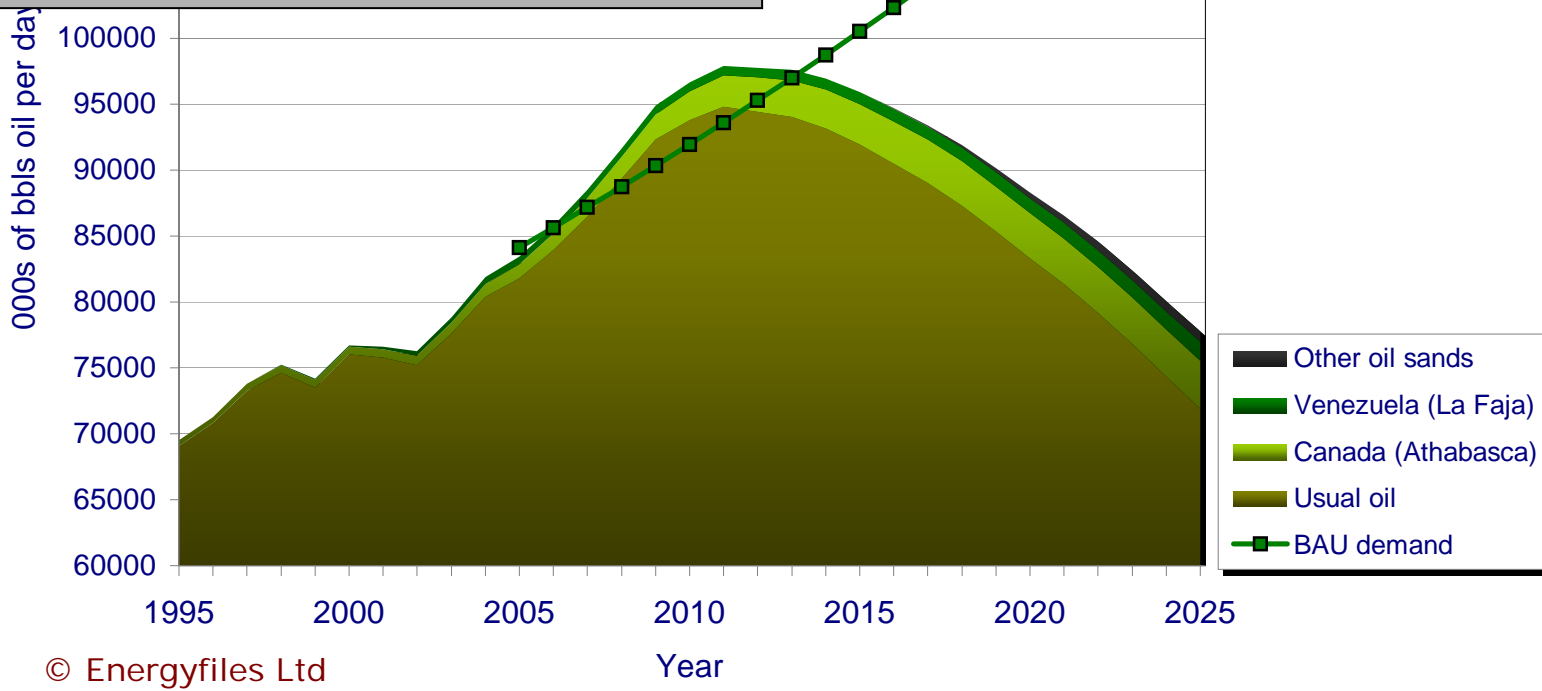
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**OIL SHALES**

*"...Shell's method, which it calls in situ conversion, is simplicity itself in concept but exquisitely ingenious in execution."*

**ROCKY MOUNTAIN NEWS, 2005**

**GLOBAL: Oil forecast (detail)**



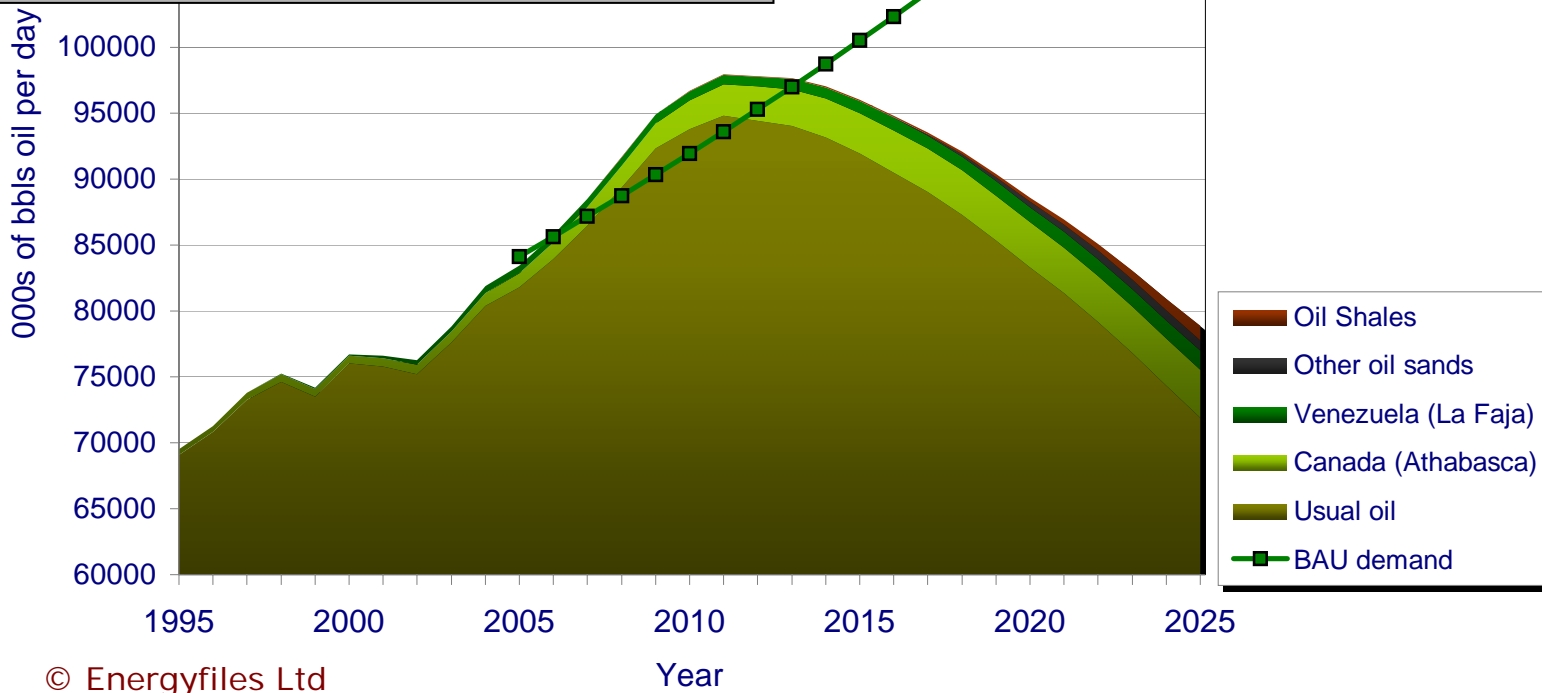
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**GAS-TO-LIQUIDS (GTL)**

*"...after years as the coming thing, GTL production appears ready to arrive"*

**AAPG, 2003**

**GLOBAL: Oil forecast (detail)**



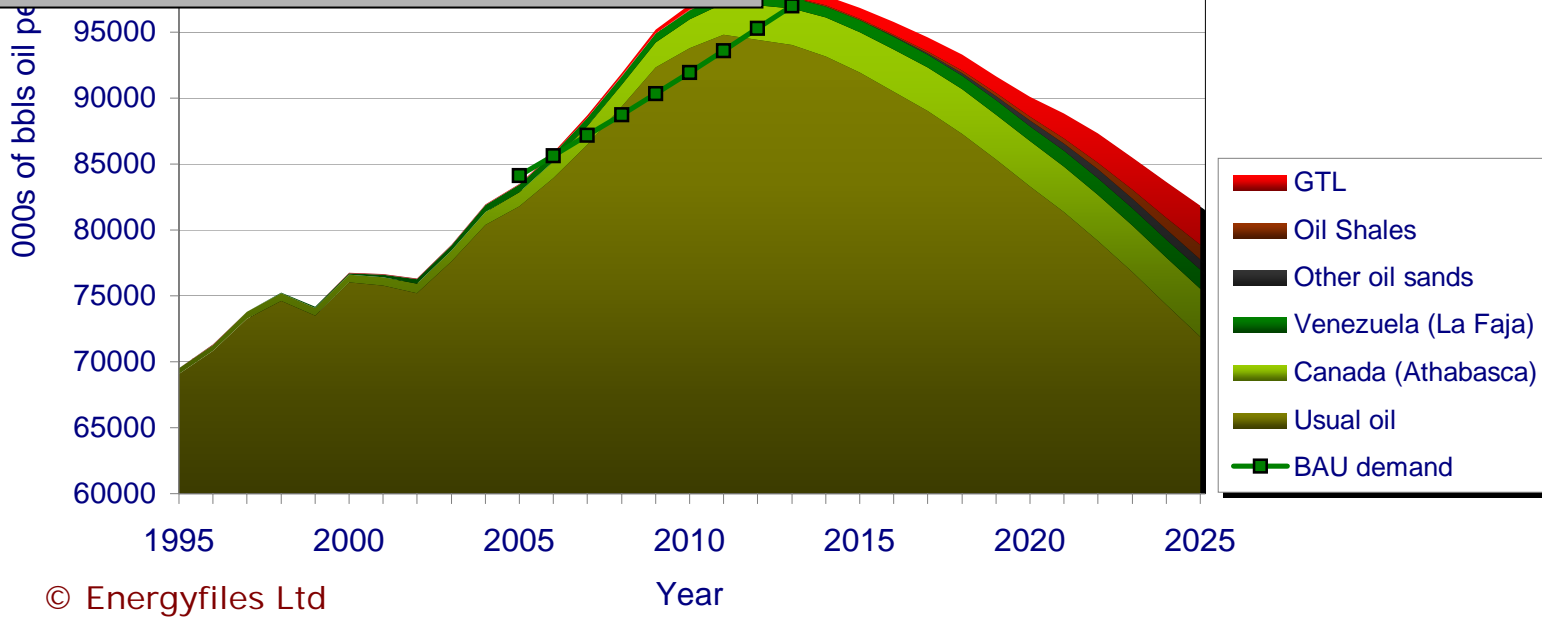
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**COAL-TO-LIQUIDS (CTL)**

*"...even alone, it [CTL] could bring an element of stability to world oil prices and thus also to the global economy."*

**YALE CENTER FOR THE STUDY OF GLOBALIZATION**

**GLOBAL: Oil forecast (detail)**



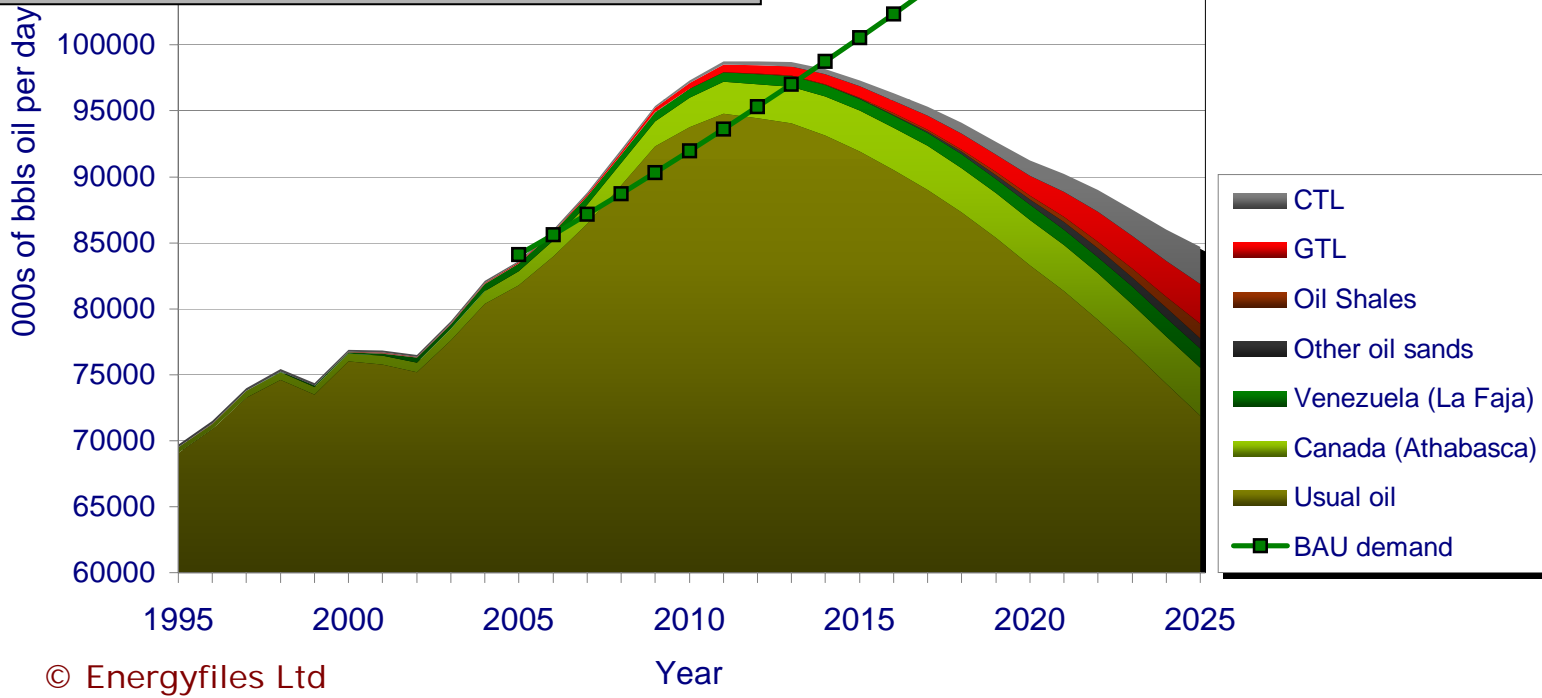
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**BIOFUELS**

*"...the world is on the verge of unprecedented growth in the production and use of biofuels"*

**RENEWABLE ENERGY WORLD, 2006**

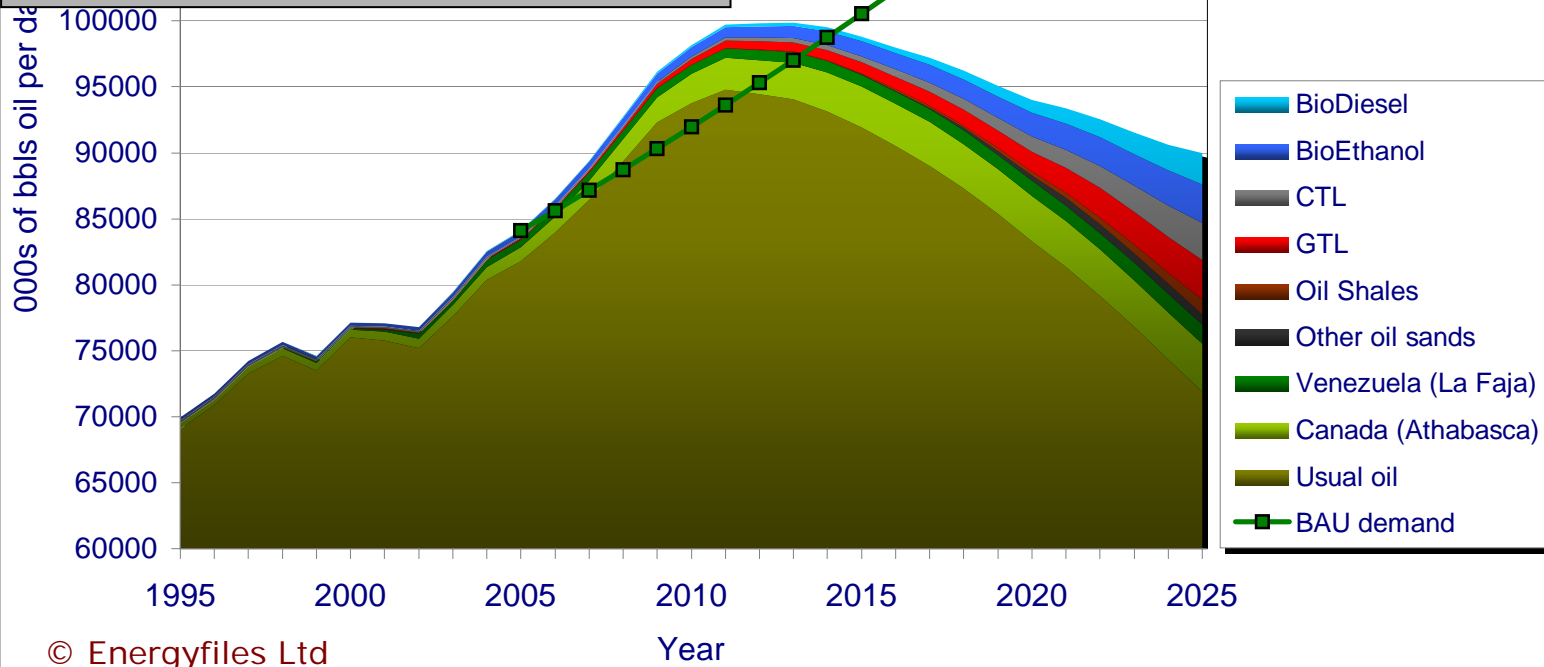
**GLOBAL: Oil forecast (detail)**

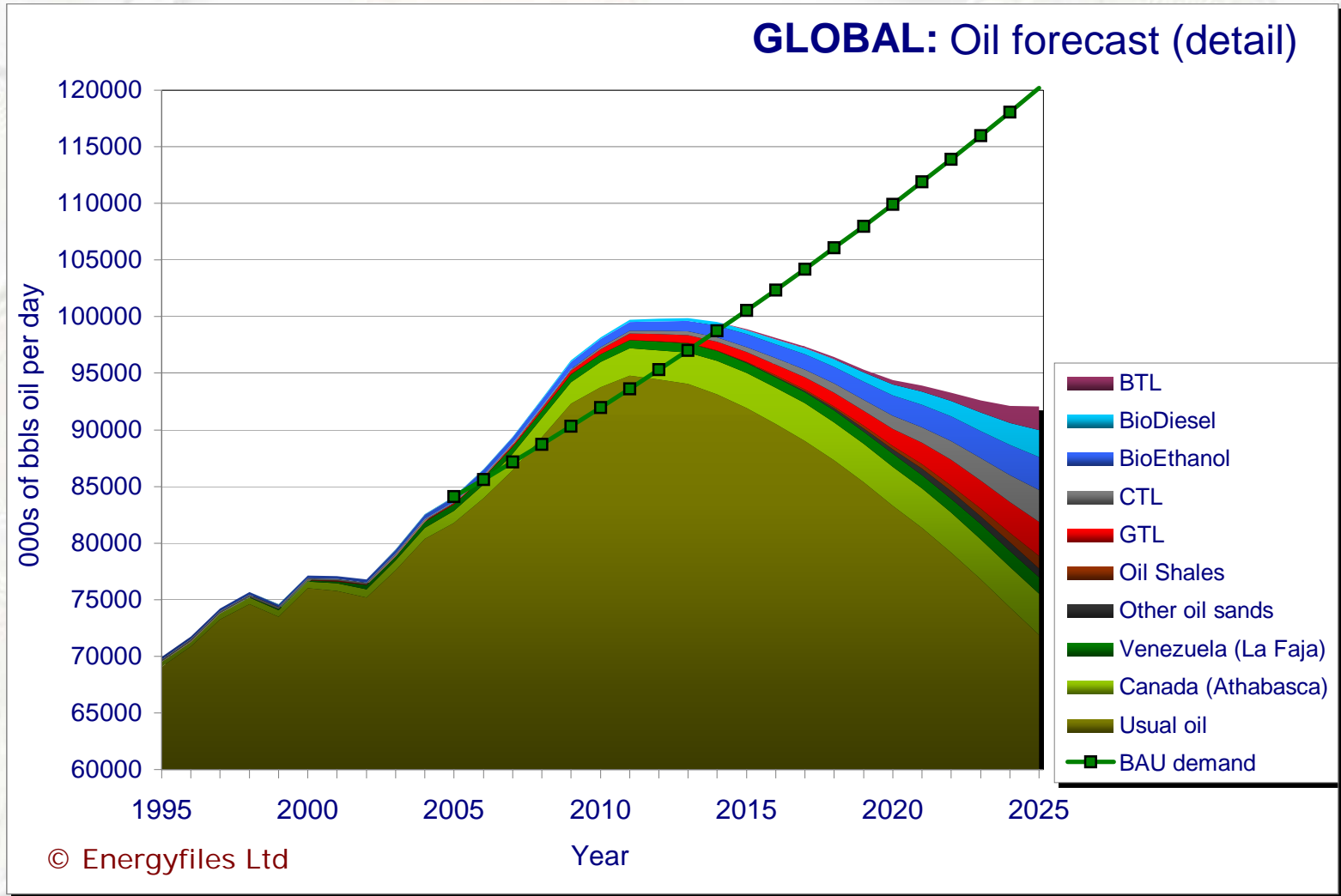


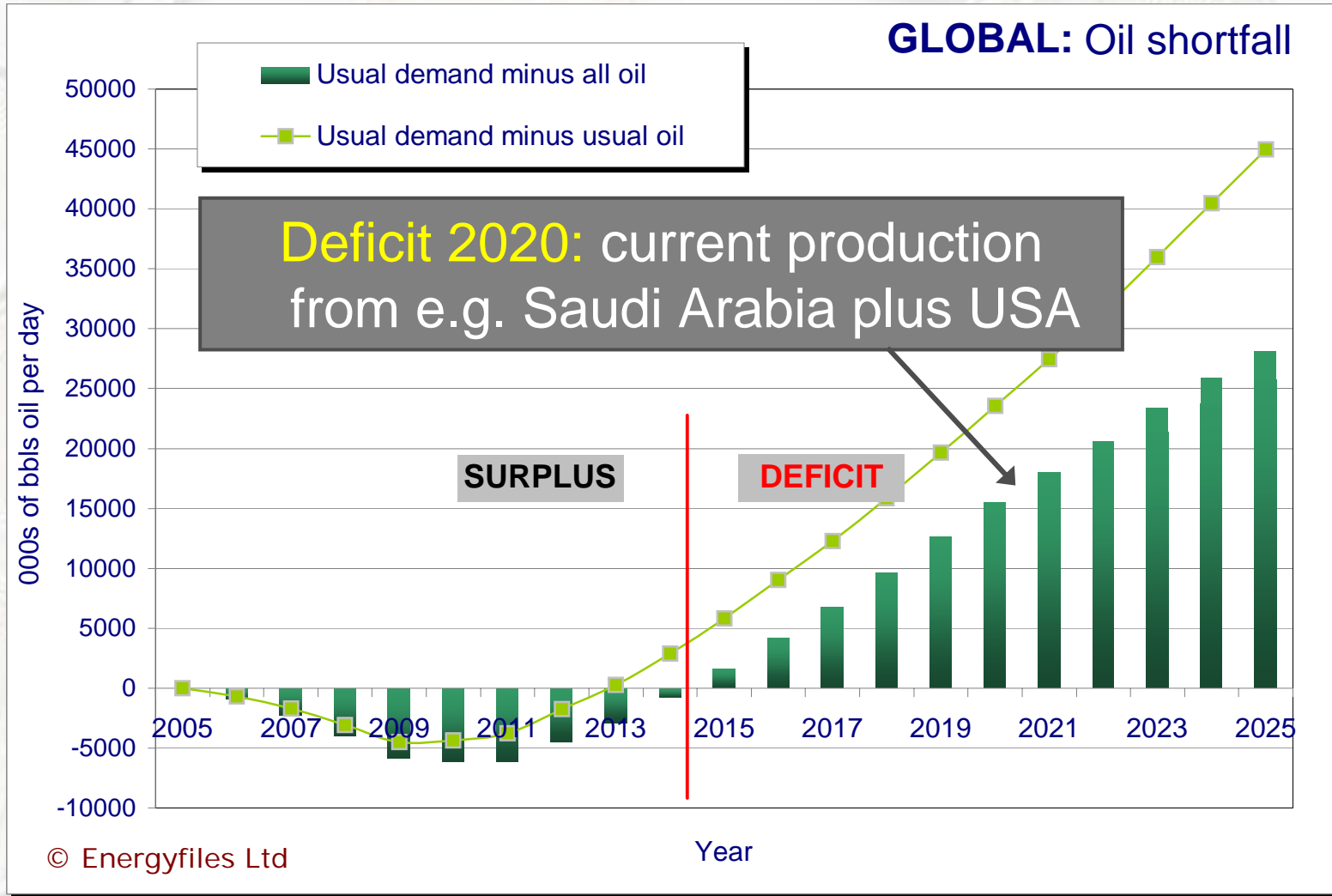
**FOOD IMPLICATIONS**

*"In 1900 25 million horses in the US accounted for 25% of agricultural land in their feed requirements – use cellulosic ethanol"*

**GLOBAL: Oil forecast (detail)**







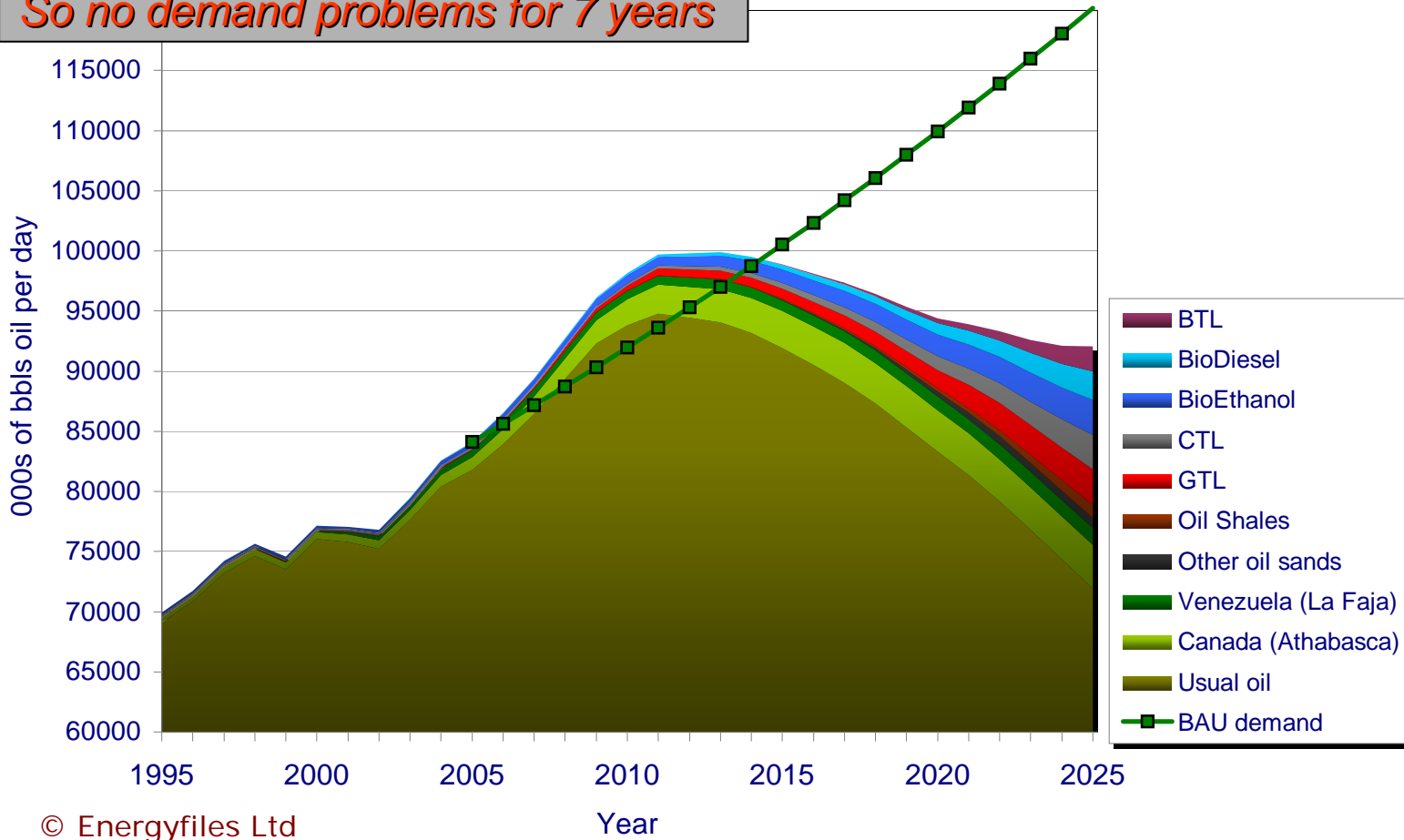
**“CLOSING”  
THE OIL  
SUPPLY GAP  
(through efficiency)**



Public transport, Washington DC  
© Energyfiles Ltd

**SURPLUS CAPACITY TO ~2014:**  
*So no demand problems for 7 years*

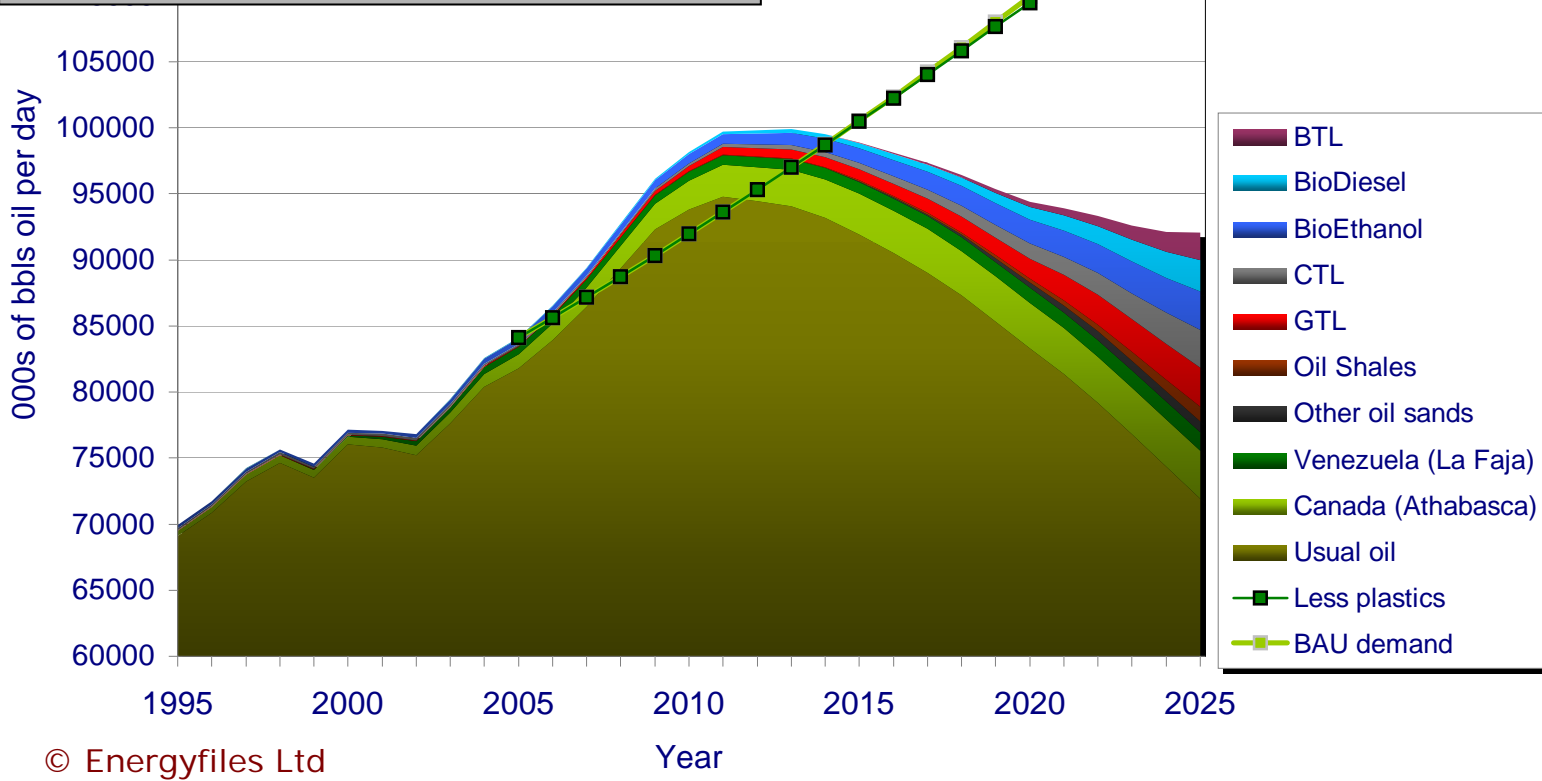
**GLOBAL: Oil forecast (detail)**



**PLASTICS:**

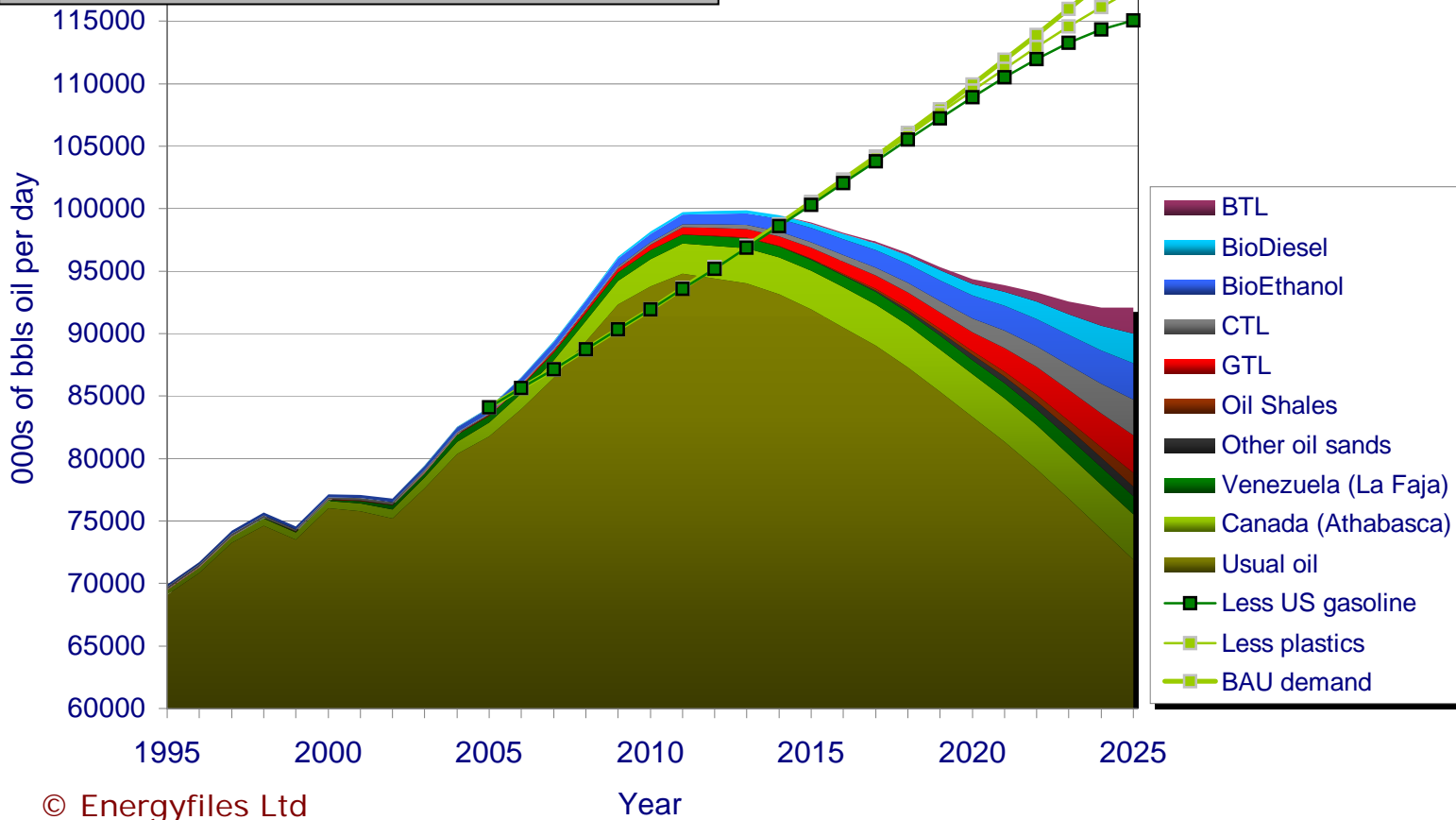
*Halve their use in 20 years, using natural alternatives and less waste*

**GLOBAL: Oil forecast (detail)**



**US GASOLINE:**  
*Move to European mpg levels*

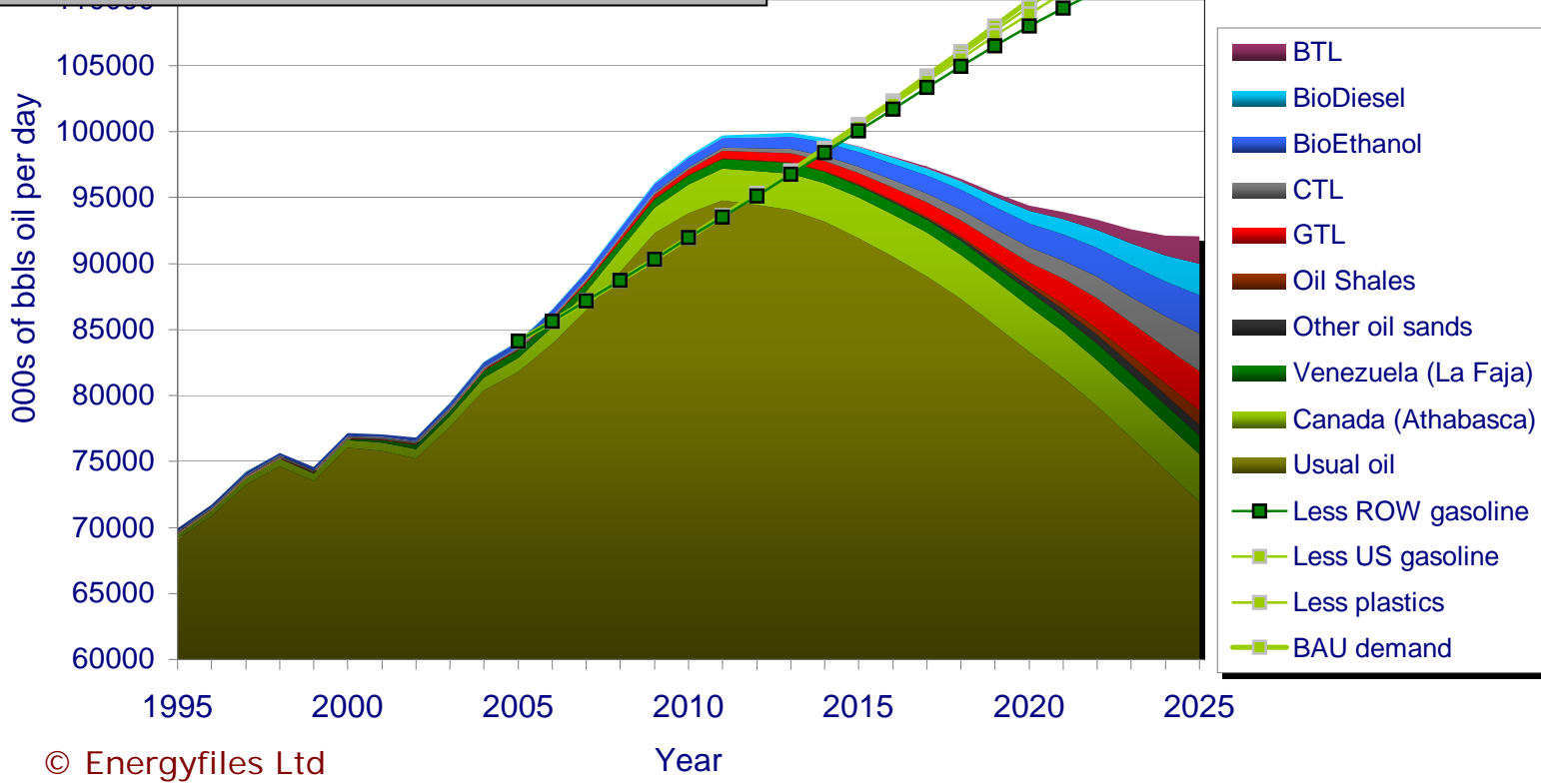
**GLOBAL: Oil forecast (detail)**



**REST OF THE WORLD  
GASOLINE:**

*Continue to improve efficiency at current rates*

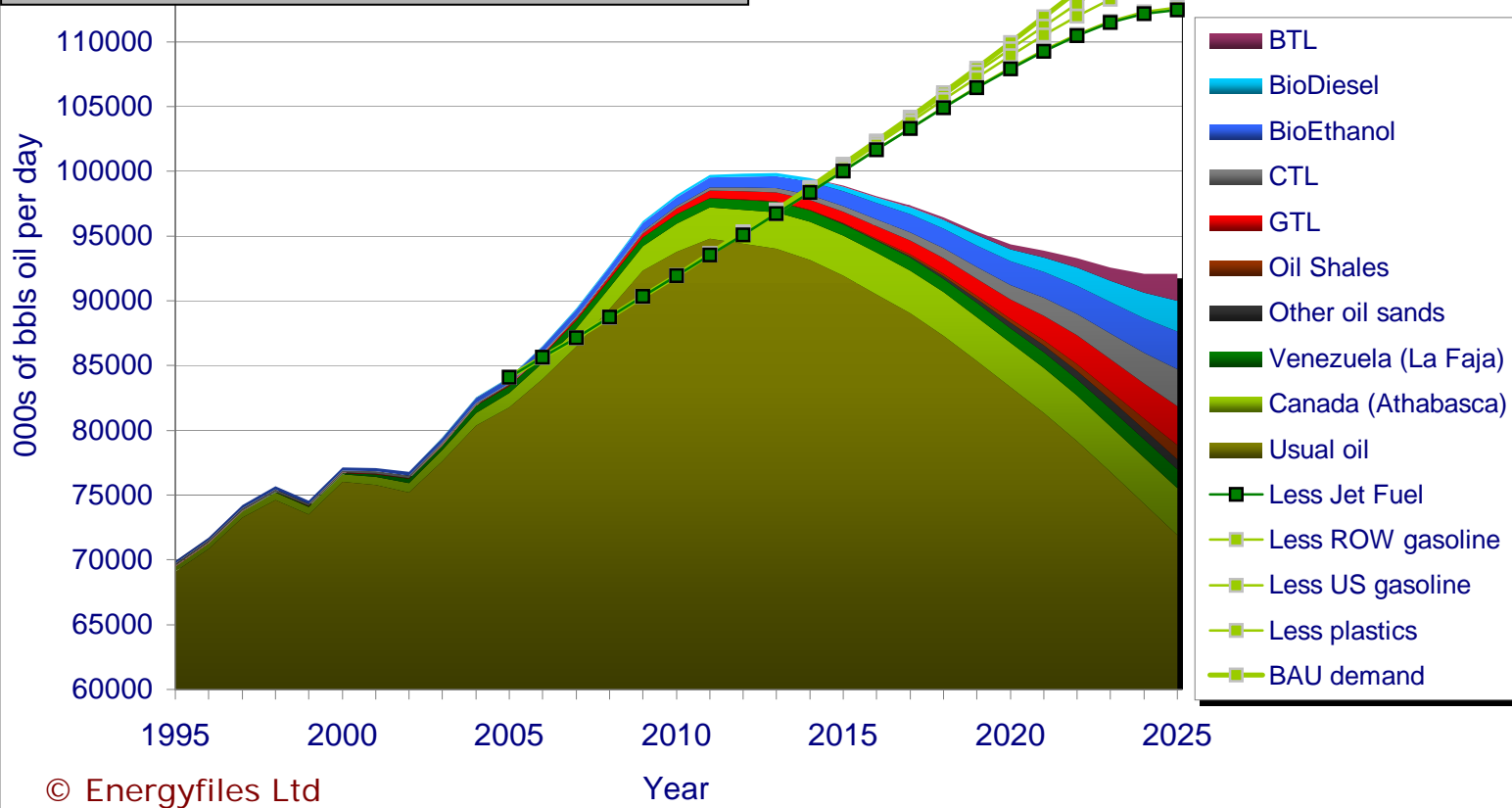
**GLOBAL: Oil forecast (detail)**



**JET FUEL:**

*Few options to save fuel with current airplane mix*

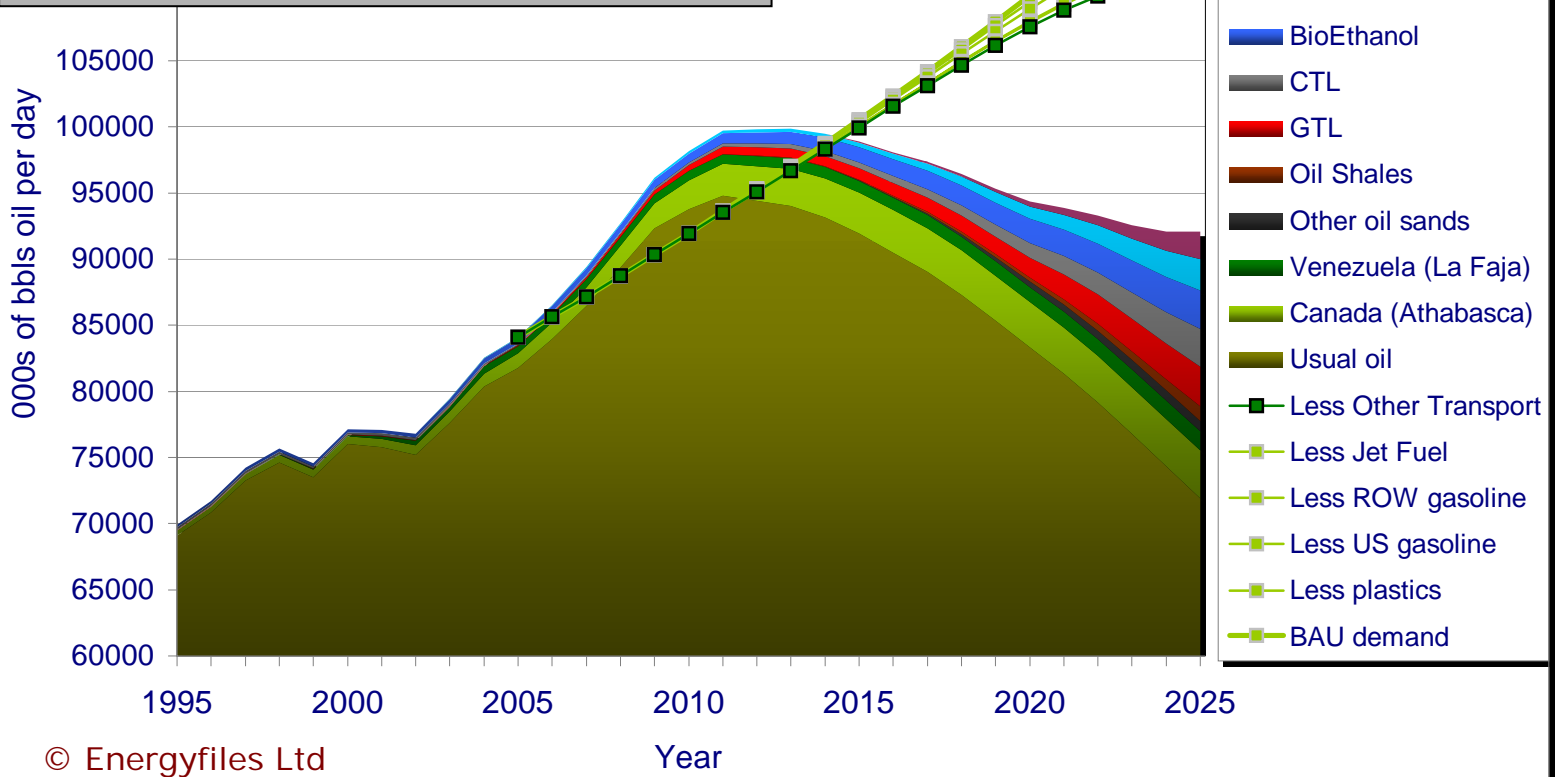
**GLOBAL: Oil forecast (detail)**



**OTHER TRANSPORT:**

*Continue to introduce improved electrified trunk and local train, metro and tram systems*

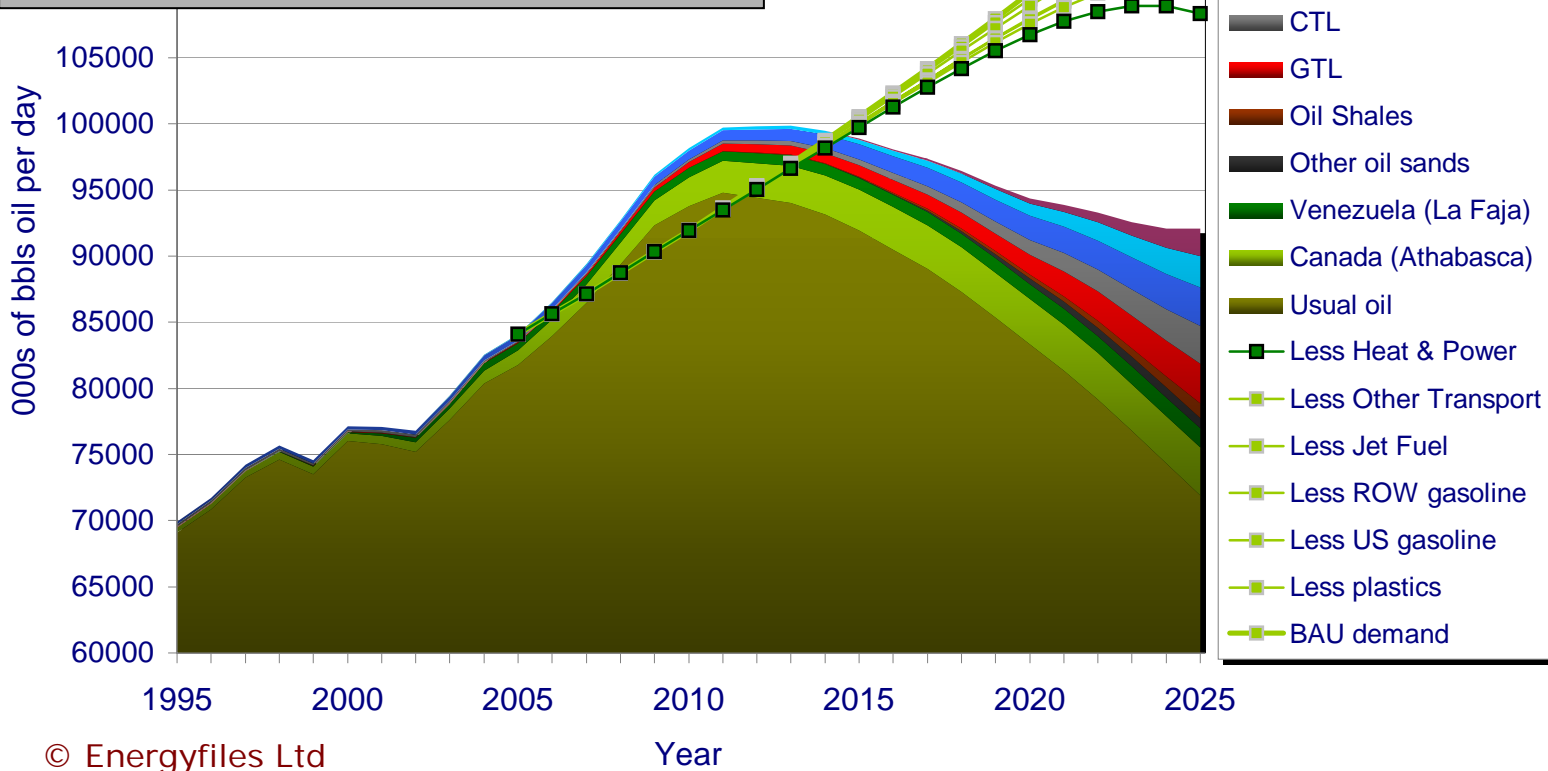
**GLOBAL: Oil forecast (detail)**

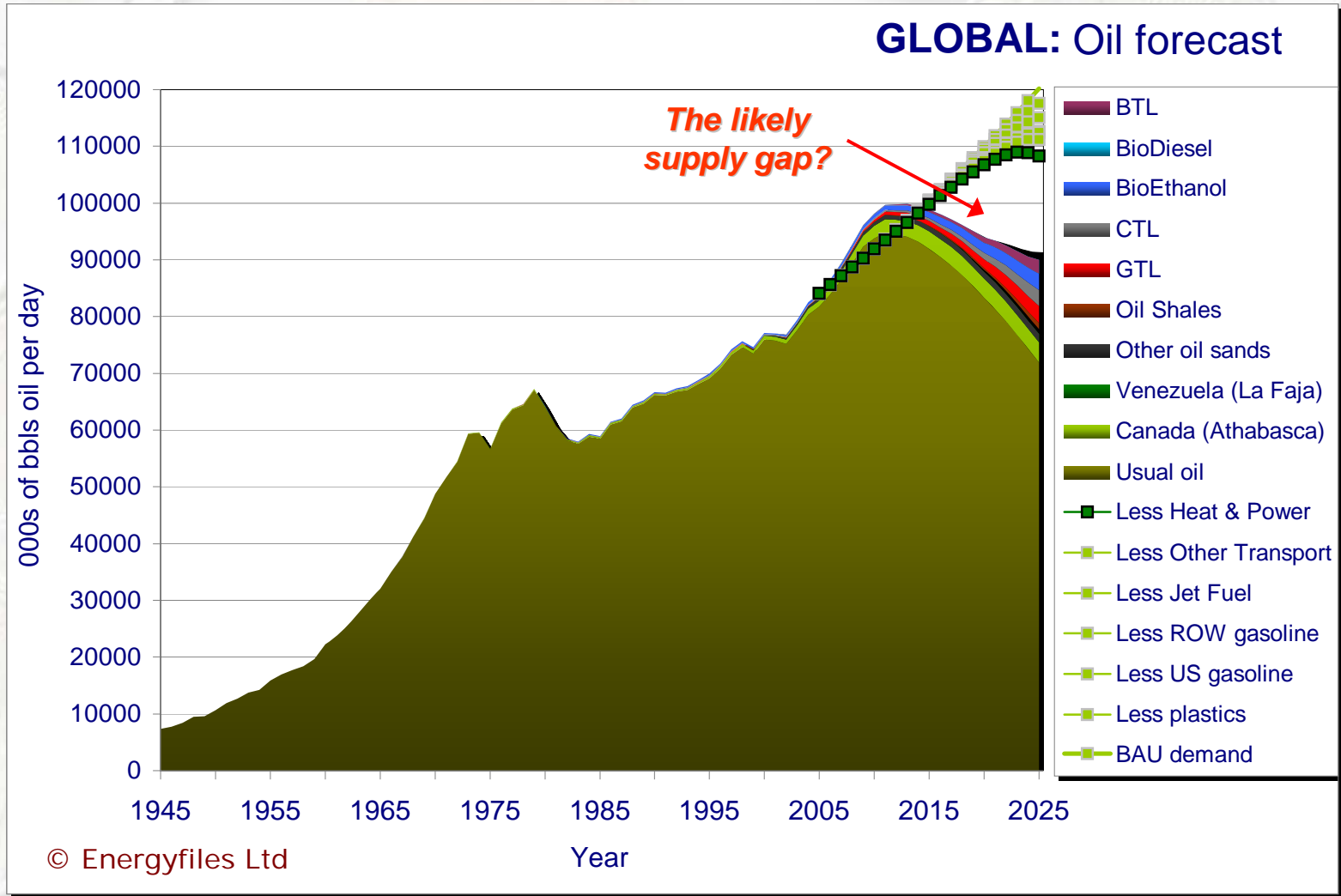


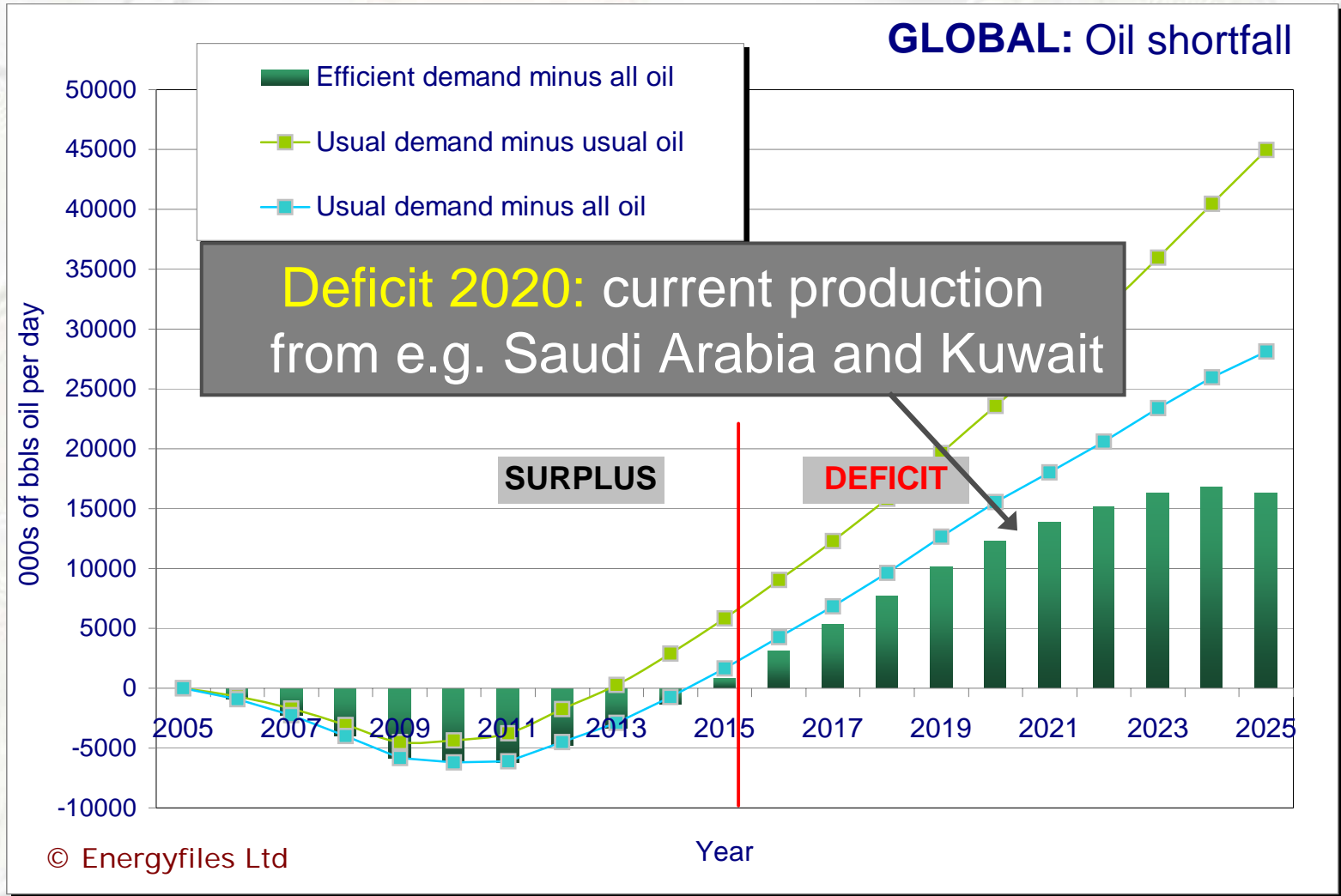
**HEAT AND POWER:**

*Replace all remaining oil-powered heat and power stations with gas, coal and renewables*

**GLOBAL: Oil forecast (detail)**







# CONCLUSIONS

- *“...demand for energy exceeds production by approximately 10 million barrels of oil equivalent per day.”*
- This was said by a Senior Vice President of Exxon Mobil.
- However he was not talking about the globe but about the USA today. He went on to say...
- *“...no combination of conservation measures, alternative energy sources and technological advances could realistically and economically provide a way to completely replace these imports in the short – or medium term.”*
- And Exxon Mobil’s solution for the USA is *“do not tamper with markets”*
- In around 12 years the globe could be in the same condition (even with all the alternatives and efficiencies)
- Should governments really do nothing at all?

## KNOWN ALTERNATIVES AND EFFICIENCY ARE NOT ENOUGH!



Vested interests do not provide the best solutions. They are clouded by wishful thinking:

*I don't pretend my analyses are exactly right, but they are realistic*

*... deal with facts not assertions*

## KNOWN ALTERNATIVES AND EFFICIENCY ARE NOT ENOUGH!

Companies and governments must take more energy risks:

*With capital intensive projects,  
innovative energy sources,  
new modes of transport  
...and through cutting  
consumption with taxes and  
rationing systems*



## KNOWN ALTERNATIVES AND EFFICIENCY ARE NOT ENOUGH!

Companies and governments must form more mergers, alliances and partnerships:

*Connecting those who have expertise, with those who have resources, with those who have capital  
...or global conflict will escalate further*



## KNOWN ALTERNATIVES AND EFFICIENCY ARE NOT ENOUGH!

Demand will want to grow faster than supply of liquid energy and most of the ready alternatives have environmental consequences

*Conservation will be a necessity*

*...but it will be painful*



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