Prospects for Production from the UKCS to 2035

Professor Alex Kemp

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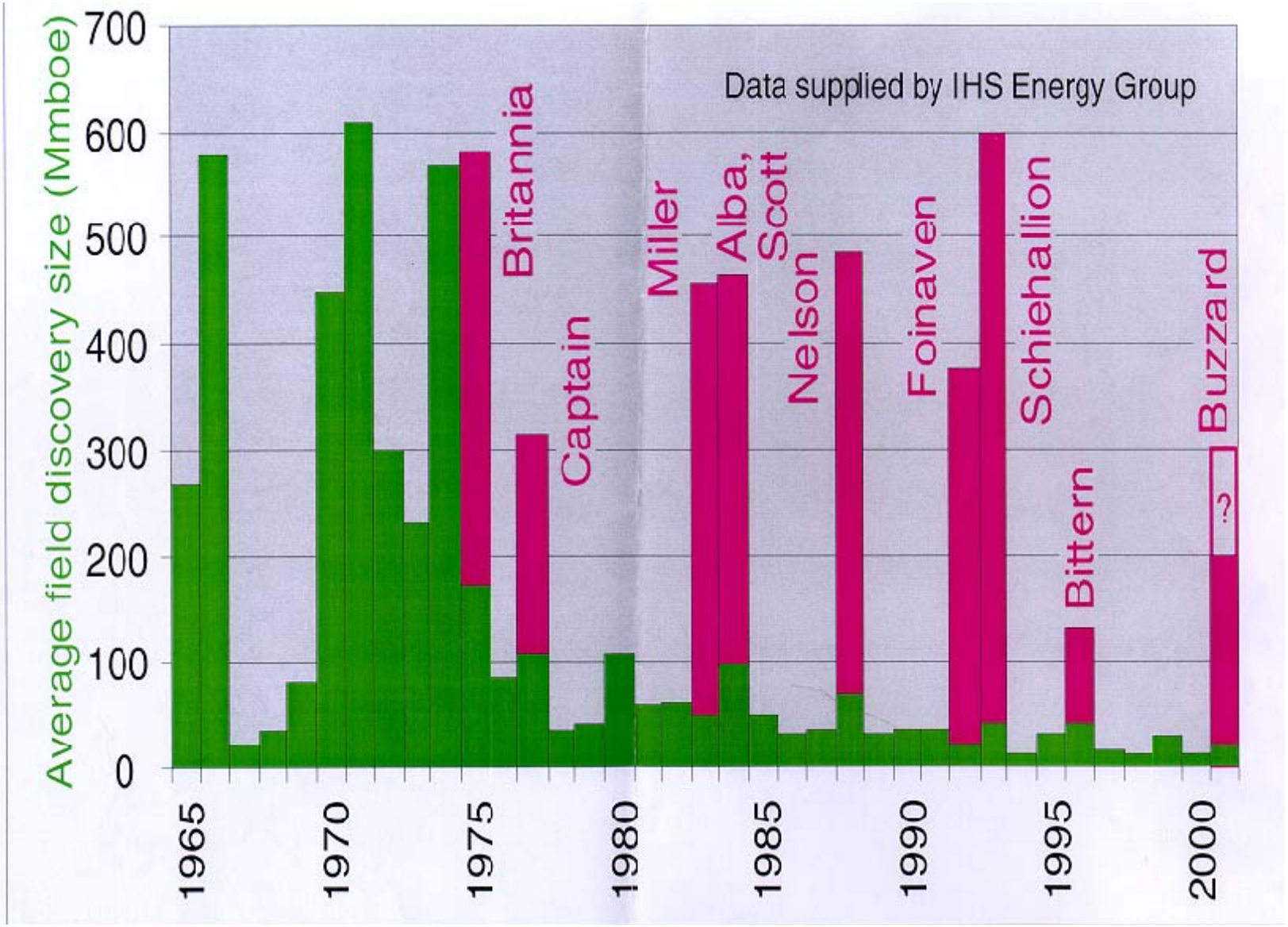

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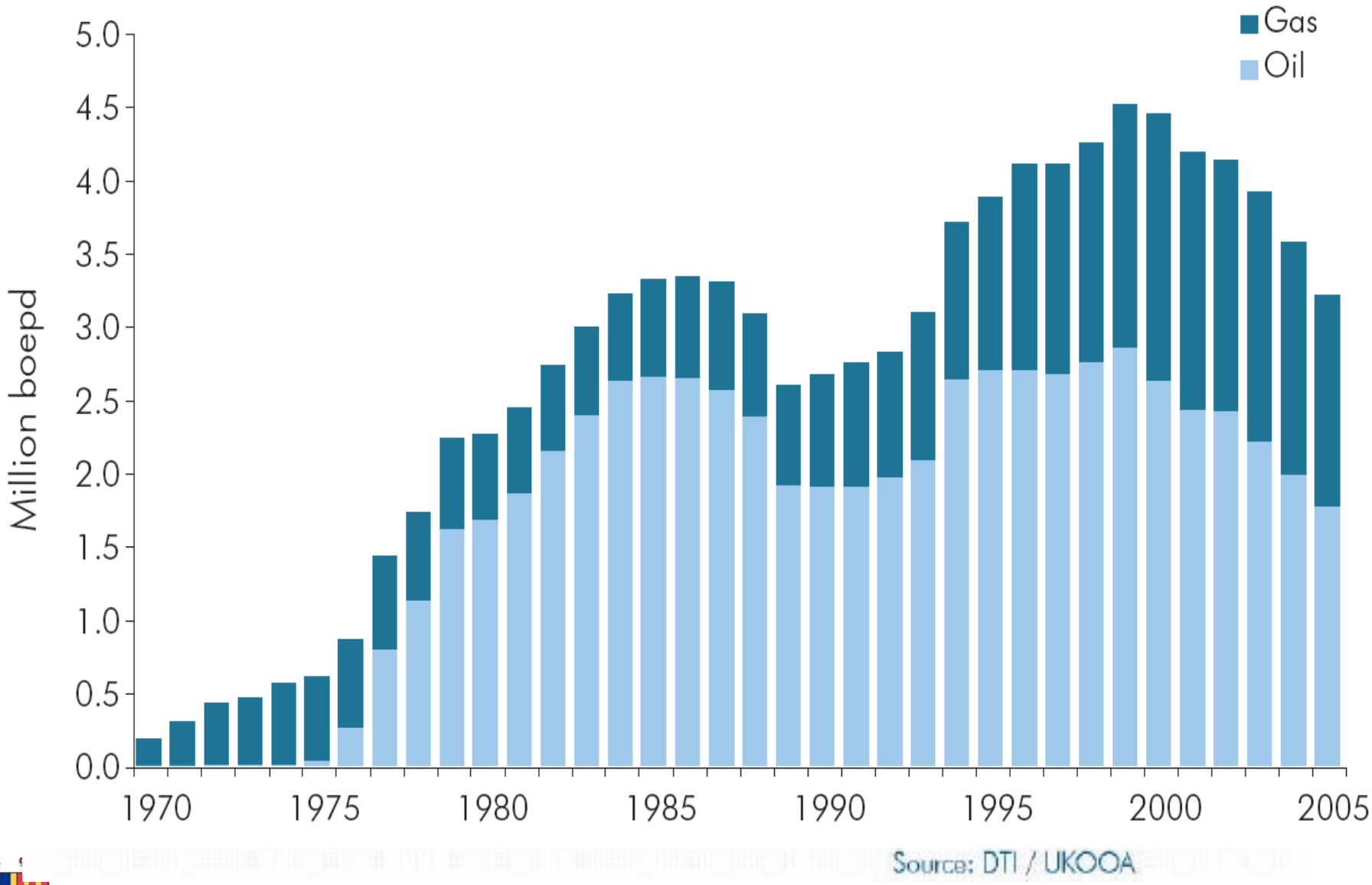
UK Oil and Gas Production 1970-2005



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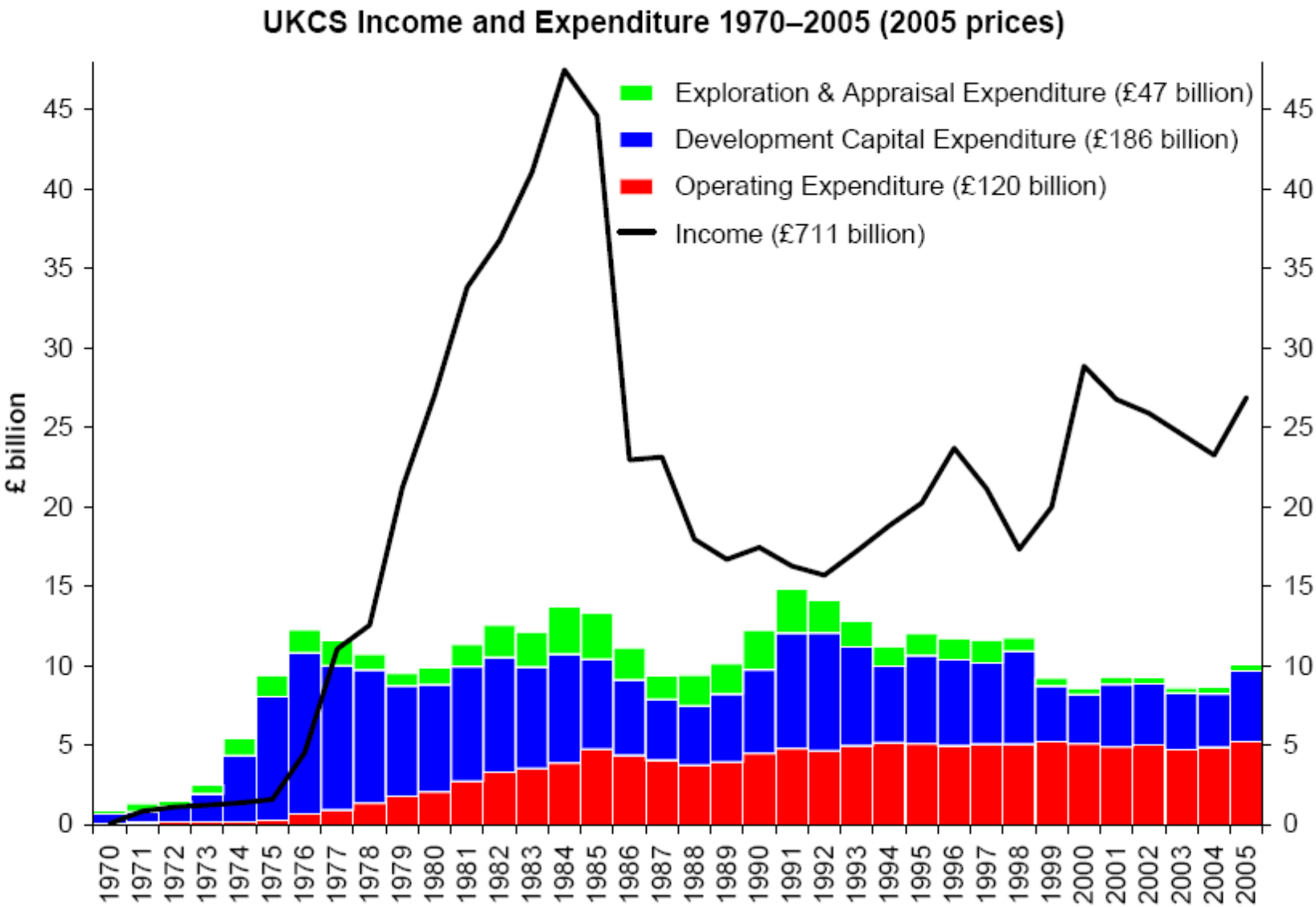

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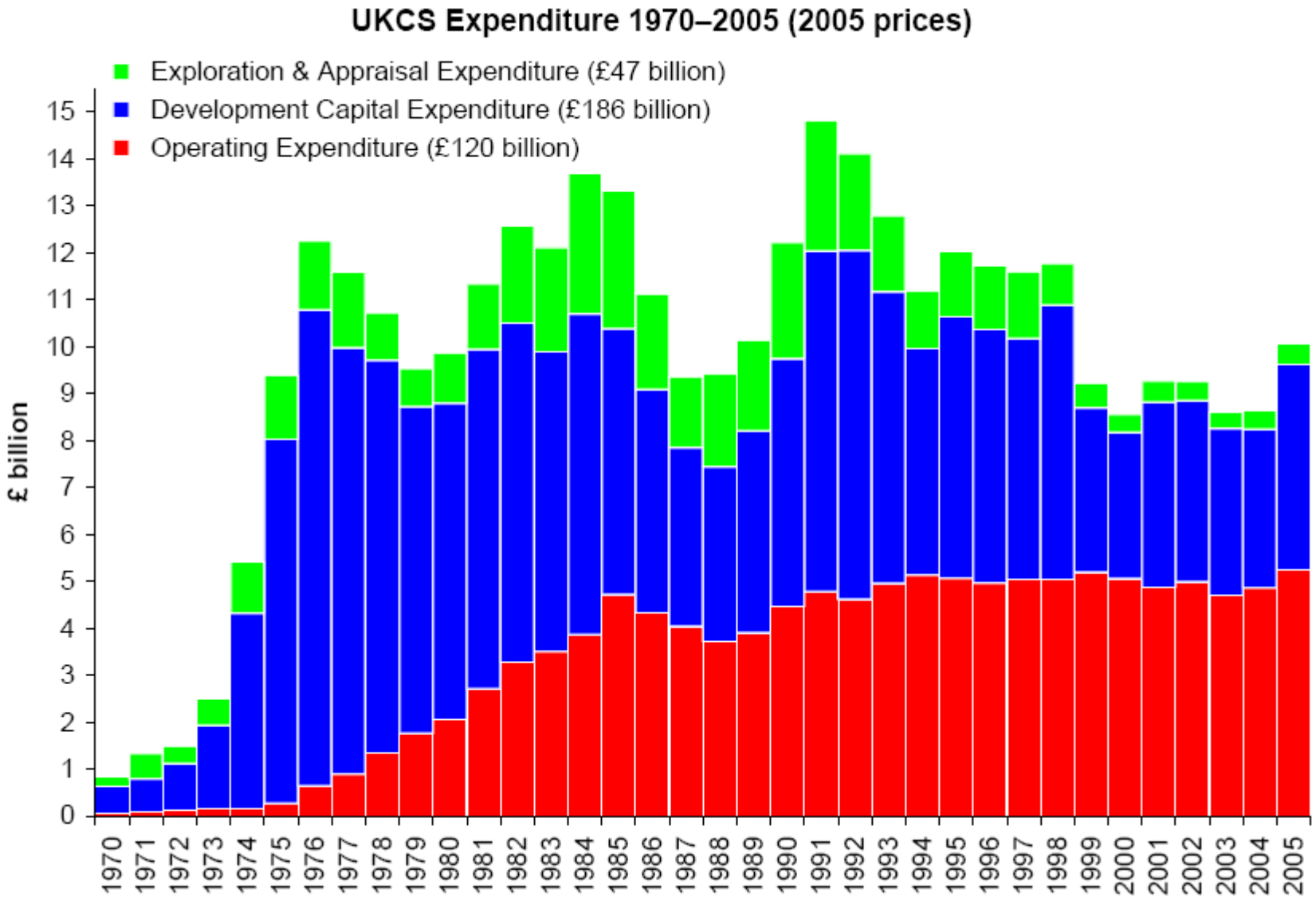

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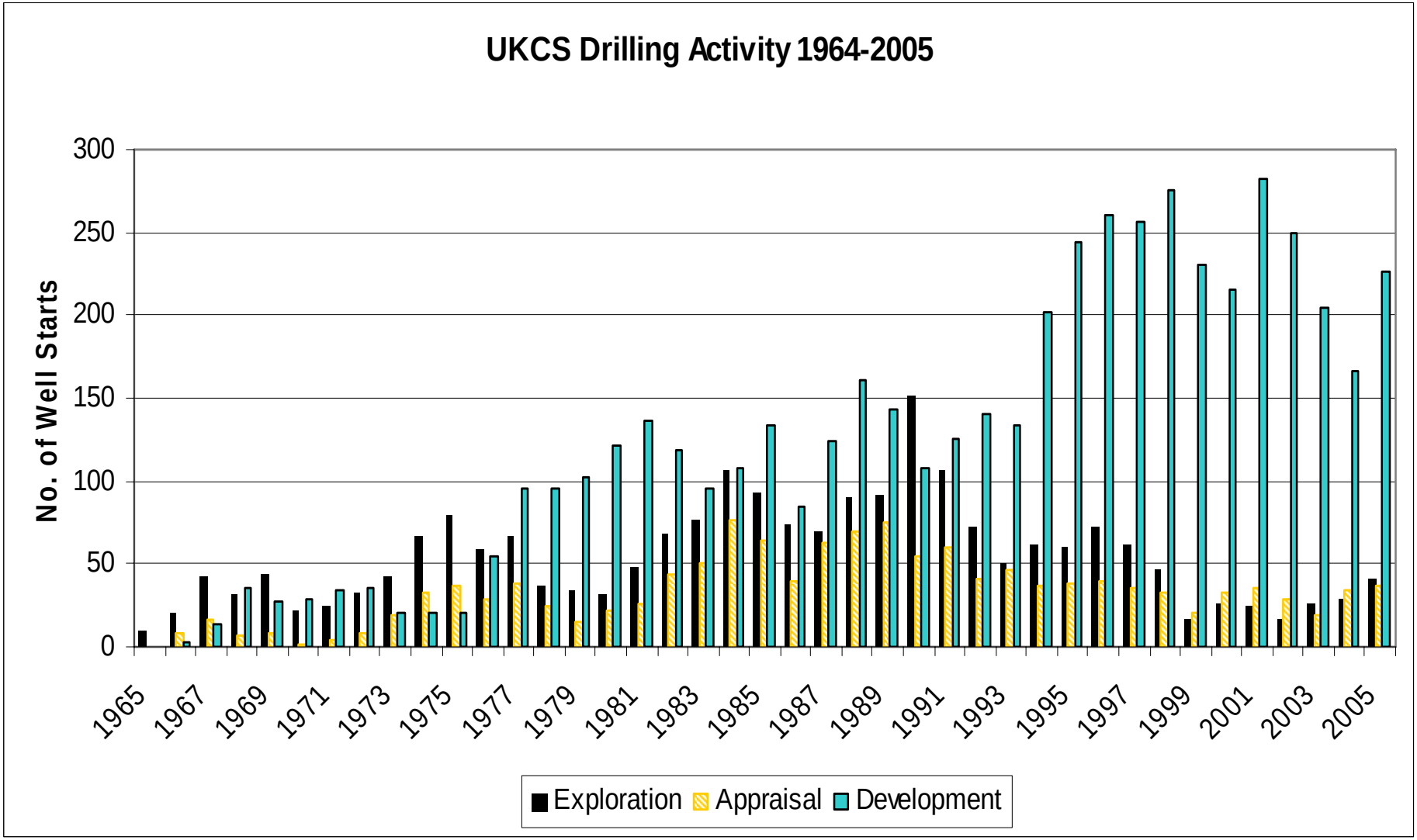

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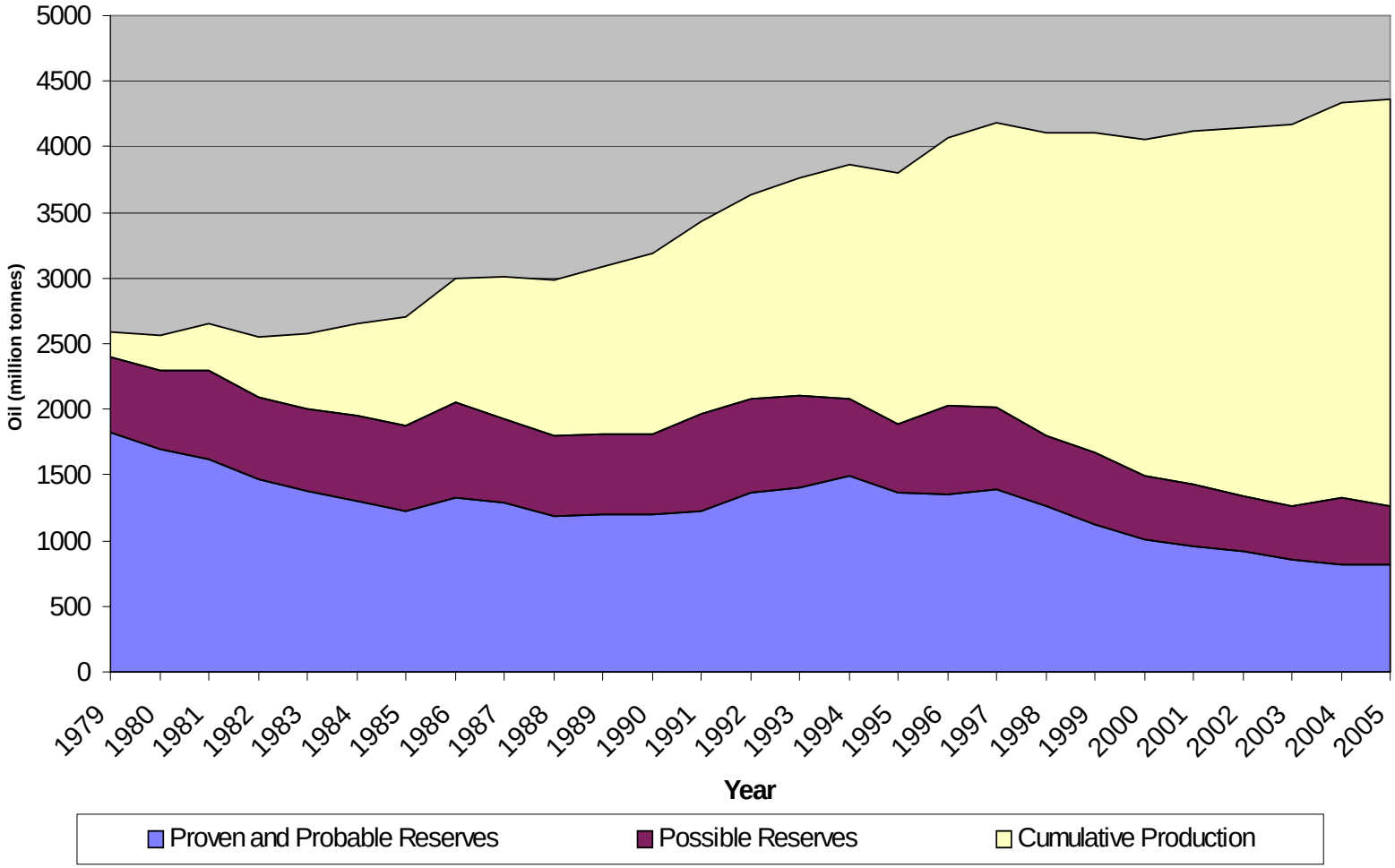
Oil Reserves v Time



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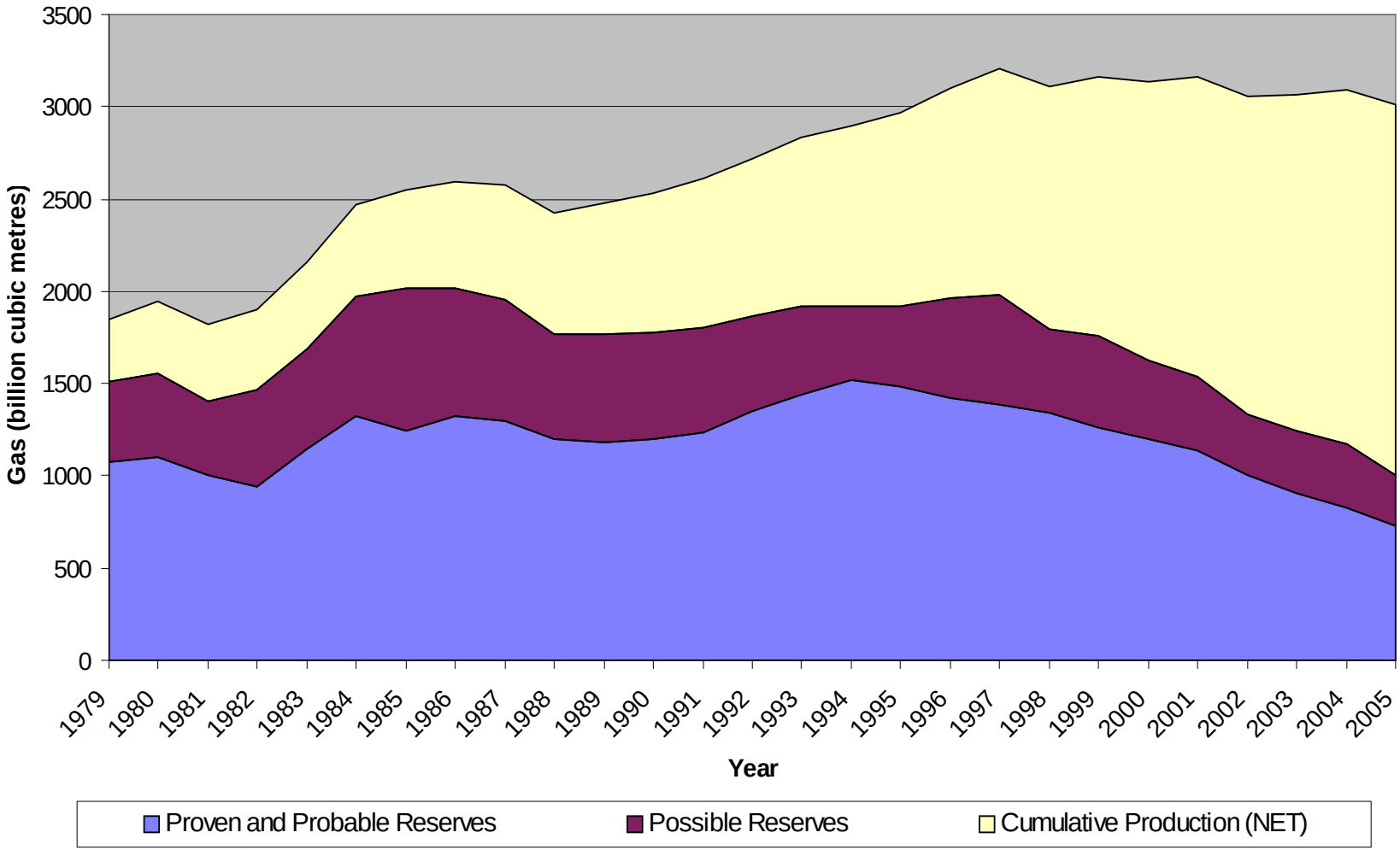
Gas Reserves v Time



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Estimates of Remaining Potential (Bn Boe (rounded)

	Low	Central	High
Reserves	6.8	10.5	15.6
PAR	0.9	2.4	4.9
Yet-to Find	4.0	8.2	18.2
Total	11.7	21.1	38.7

Total depletion to date: 35.4 bn boe

Source: DTI

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Methodology and Assumptions

1. Large financial simulation model including Monte Carlo risk analysis employed utilising 3 databases as follows:
    a. Historic field production, discoveries, field sizes, E and A effort.
    b. UKOOA field database (late 2005 vintage), sanctioned fields (316), incremental projects (112), probable (19) and possible fields (23).
    c. Database of technical reserves updated (215 fields). Includes some fields formerly in possible category.

2. New discoveries were modelled according to following procedures:

    a) Exploration effort based on combination of (i) average since 1997 and (ii) prospective oil/gas price behaviour (sustained).

Three oil/gas price cases as follows:

	Oil Price (real) $/bbl	Gas Price (real) Pence/therm
High	40	36
Medium	30	28
Low	25	24

RBS Survey 2006

Prices used for long-term investment decisions. Median values:

Oil: $33/bbl

Gas: 23 pence/therm

The numbers of exploration wells (linear trend) in relation to the 3 price cases are as follows:

	2006		2030
High	50		38
Medium	38		27
Low	31		20

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b) Success rates based on combination of (i) experience in period since 1997 and (ii) size of effort. In relation to (ii) it is assumed that higher effort is associated with more discoveries but lower success rate than with medium effort. Similarly with medium and low effort. For whole of UKCS success rates: under
Medium Effort = 23%
High Effort = 19%
Low effort = 24%

Technological progress maintains these success rates in the period to 2030.

c) Data on discoveries for the period from 1997 were taken from the database.

3. The aggregate historic data on (i) exploration effort and (ii) discoveries were disaggregated according to main regions, namely SNS, CNS, MF, NNS, WOS and IS. Regional trends were established for relative exploration effort, discoveries and success rates. This includes splitting according to type (oil, gas and condensate).

4. Using the above information the Monte Carlo technique was employed to project discoveries in all 6 regions in the period to 2030.

5. In the Monte Carlo modelling it was assumed that the size distribution of discoveries would be lognormal following historic evidence. The SD was set at 50% of the mean value. The mean size of field decline through the period was again based on historic evidence. Monte Carlo modelling was also used to calculate the field development costs. For each region the average development cost (per boe) of fields sanctioned in 1990's plus the probable and possible fields was calculated. The SD was assumed to be 20% of the mean.

6. The annual numbers of field developments going ahead were assumed to be constrained by the capacity (physical and financial) of the industry. Over the longer term the ceilings on the total numbers of potential field developments (excluding incremental investments) were assumed to be as follows:

High Price	22
Medium Price	20
Low Price	17

The constraint took the form of curtailing the number of fields in the technical reserves category from going ahead. The Monte Carlo technique was used to project through time the particular fields in this category which could be developed.

7. The numbers of field developments were constrained by an economic hurdle. Costs of capital of 10% and 15% in real, post-tax terms were employed. Minimum NPVs of £10 million required to reflect risk: reward relationship.

Incremental Projects

1. Those currently being examined should mostly be executed in next 3 years if they pass economic hurdle.
2. It is very likely that further incremental projects will be examined in medium/longer term.
3. To obtain understanding of eventual potential further hypothetical incremental projects were modelled. They are based on trends in volumes and costs for incremental projects over the past few years.
4. The execution of the additional incremental projects depends on the prolongation of the lives of the infrastructure and possibly other incentives.
5. No guarantee that extra projects will be undertaken.

Probable and Possible Fields

- Average size 14.5 mmboe
- Average lifetime cost $15.3/boe

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$40/bbl and 36p/therm

	NPV @ 10% £m		MMBOE		Devex /bbl $		Opex /bbl $		Devex + Opex /bbl $		Devex + Opex + Aban /bbl $	
Probable Incremental Projects												
Average		37.24		8.44		7.71		2.92		10.64		10.90
sd		39.84		8.88		7.56		3.79		11.35		12.02
68%	4.34	70.69	1.86	13.50	3.12	11.43	0.00	7.01	3.12	18.45	3.12	19.11
95%	-1.41	119.17	0.37	30.97	0.00	16.23	-0.05	12.32	-0.05	28.55	-0.05	30.47
Possible Incremental Projects												
Average		63.27		19.90		9.75		3.33		13.09		13.22
sd		147.28		46.61		5.93		3.49		9.42		9.96
68%	2.01	80.90	3.03	18.88	4.63	15.17	0.44	5.79	5.07	20.95	5.07	20.95
95%	-3.25	347.62	0.51	129.86	0.00	22.19	0.00	12.10	0.00	34.29	-0.00	35.49

$40/bbl and 36p/therm

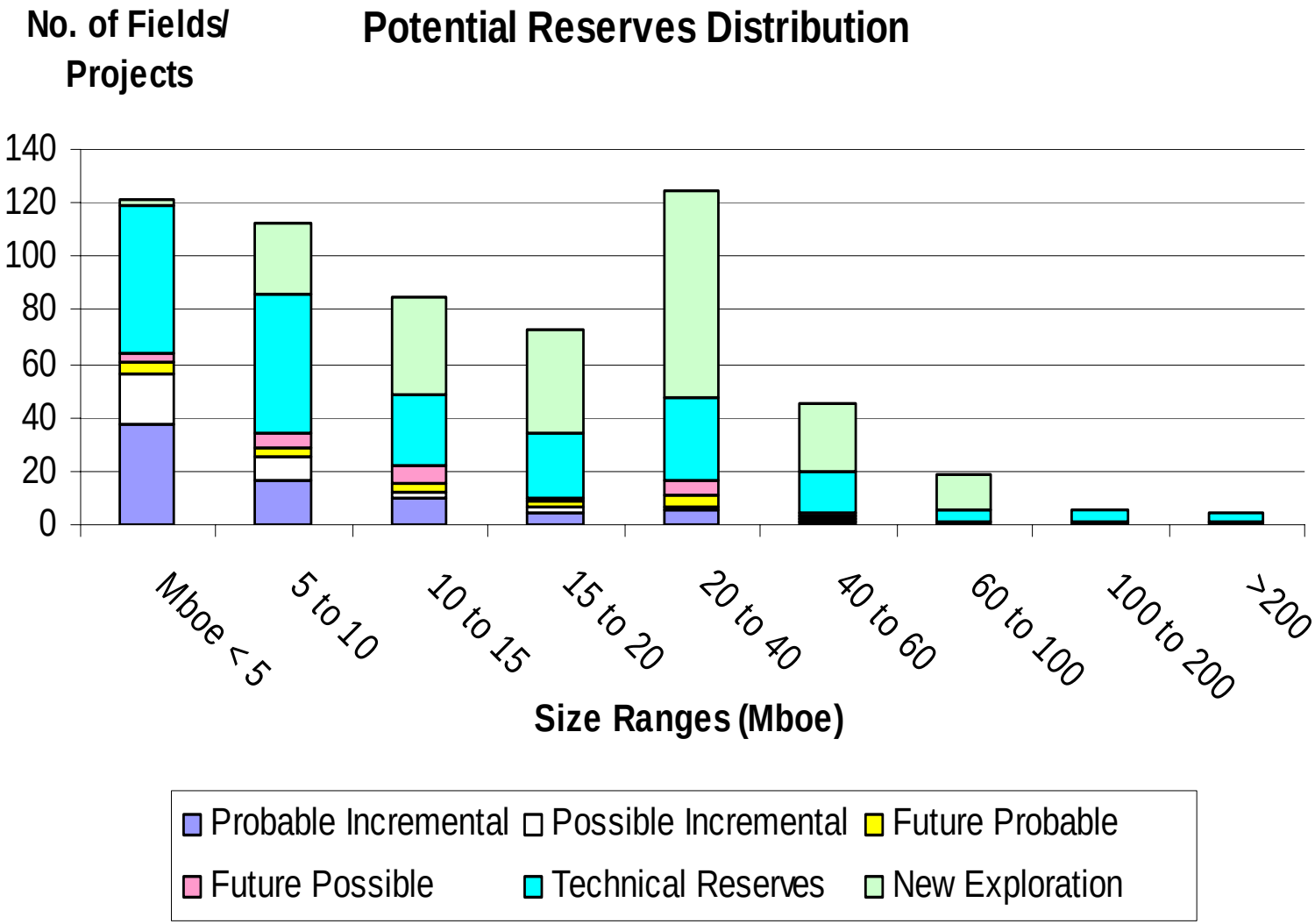
	NPV @ 10% £m		MMBOE		Devex /bbl $		Opex /bbl $		Devex + Opex /bbl $		Devex + Opex + Aban /bbl $	
All Future Fields												
Average		61.32		14.52		9.45		5.08		14.53		15.29
sd		49.45		11.53		6.73		3.24		9.97		10.61
68%	-7.70	104.11	2.27	22.15	2.00	14.50	0.00	7.06	2.00	21.57	2.00	22.98
95%	2.98	153.47	2.65	44.35	3.28	19.24	0.00	12.26	3.28	31.50	3.28	33.55
Probable Future Fields												
Average		63.88		14.90		8.91		5.02		13.93		14.70
sd		50.32		13.74		8.22		2.61		10.83		11.53
68%	25.21	135.87	4.48	22.91	4.74	11.11	4.03	6.20	8.77	17.31	8.92	18.56
95%	1.58	150.88	2.79	47.19	4.19	28.51	0.00	10.57	4.19	39.08	4.19	41.52

$40/bbl and 36p/therm

	NPV @ 10% £m		MMBOE		Devex /bbl $		Opex /bbl $		Devex + Opex /bbl $		Devex + Opex + Aban /bbl $	
Possible Future Fields												
Average		59.20		14.21		9.90		5.12		15.03		15.79
sd		49.74		9.64		5.34		3.75		9.09		9.68
68%	19.98	102.13	6.17	22.03	4.39	16.11	0.44	7.63	4.83	23.74	4.95	25.19
95%	6.57	170.07	3.08	33.68	2.70	19.08	0.00	13.04	2.70	32.12	2.70	33.83
All Technical Reserve Fields												
Average		63.09		23.40		10.12		9.01		19.13		20.01
sd		101.92		53.08		16.50		3.40		19.90		20.29
68%	9.82	101.78	3.14	32.19	6.66	11.19	6.10	12.26	12.76	23.45	13.40	24.57
95%	2.11	317.40	1.00	116.09	3.91	13.56	0.50	14.81	4.41	28.38	4.54	29.71

$40/bbl and 36p/therm

All New Exploration Fields	NPV @ 10% £m		MMBOE		Devex /bbl $		Opex /bbl $		Devex + Opex /bbl $		Devex + Opex + Aban /bbl $	
Average		76.79		26.98		8.89		9.79		18.67		19.56
sd		60.96		19.31		2.05		2.08		4.12		4.33
68%	28.31	129.71	11.86	44.75	6.91	10.93	7.78	11.88	14.69	22.81	15.38	23.90
95%	14.21	219.80	7.23	80.19	4.95	13.00	5.54	13.99	10.49	26.98	10.98	28.28



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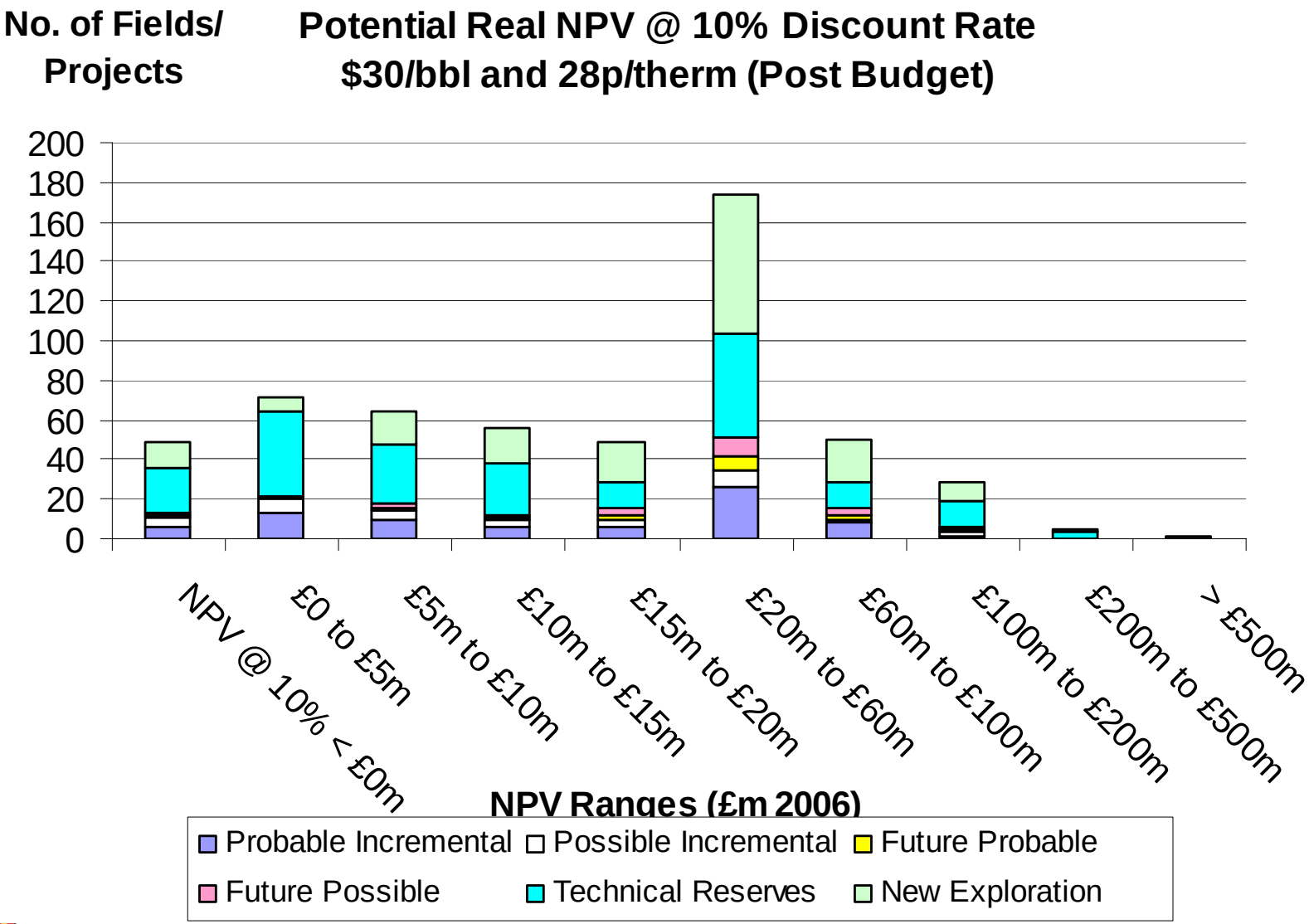

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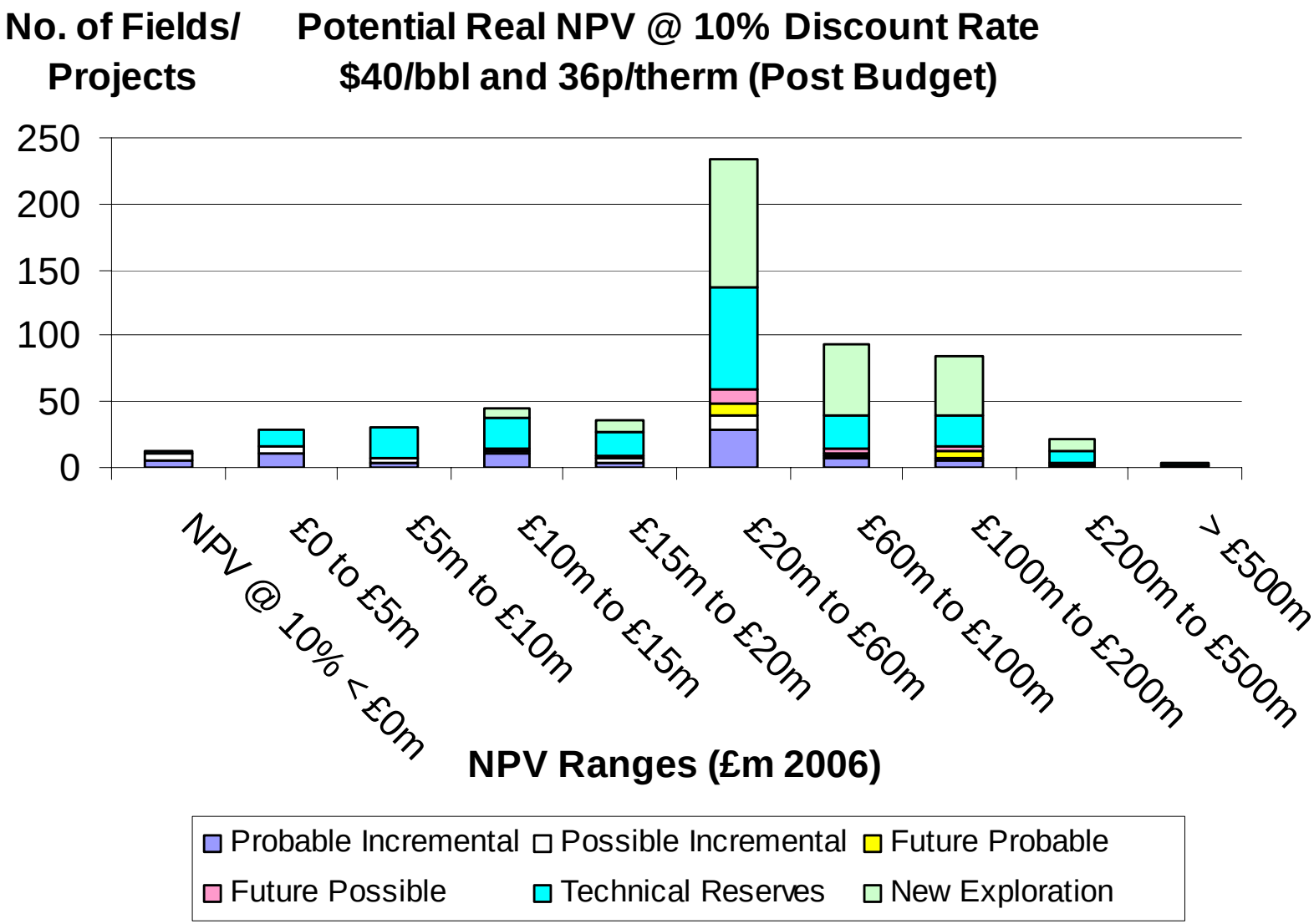

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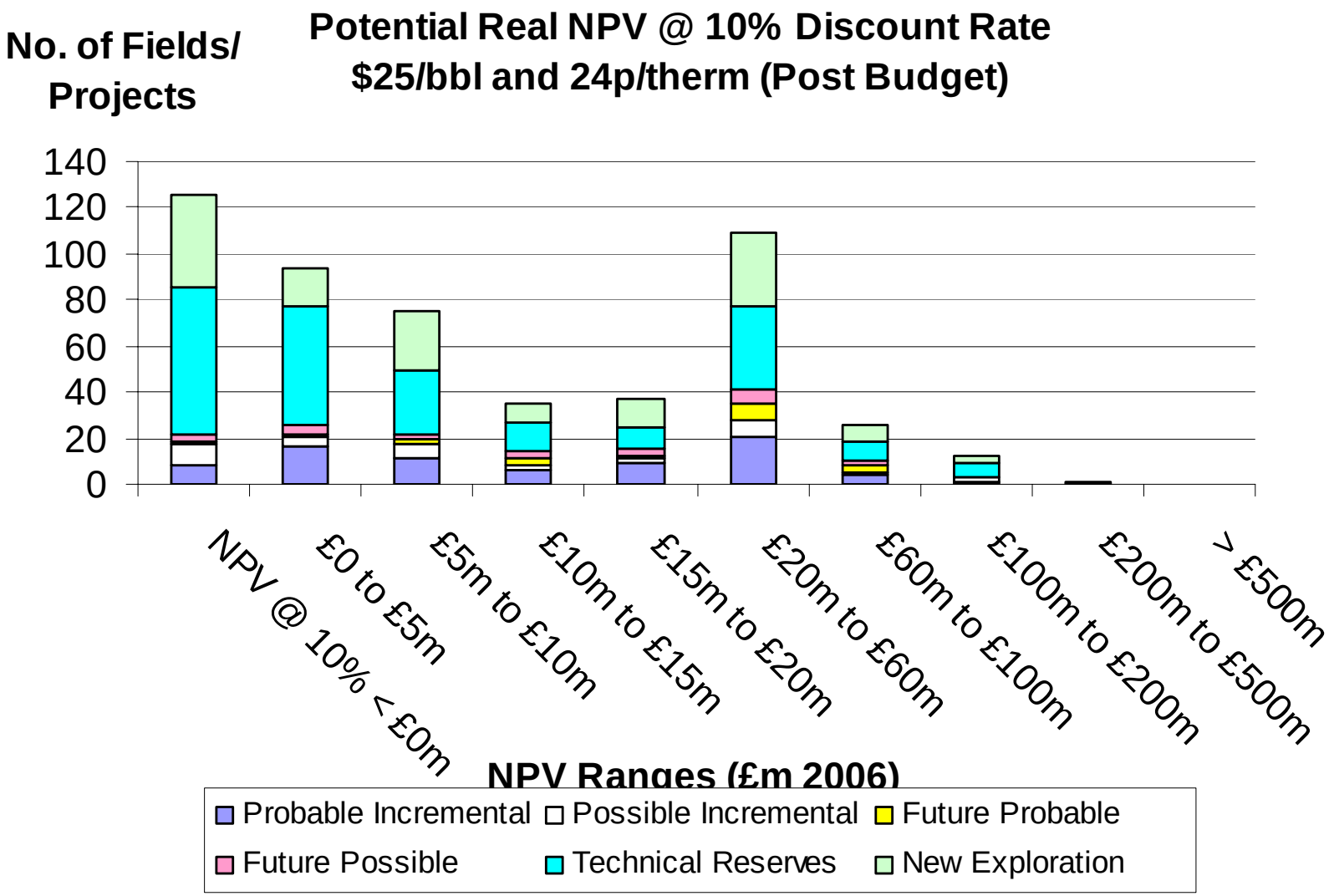
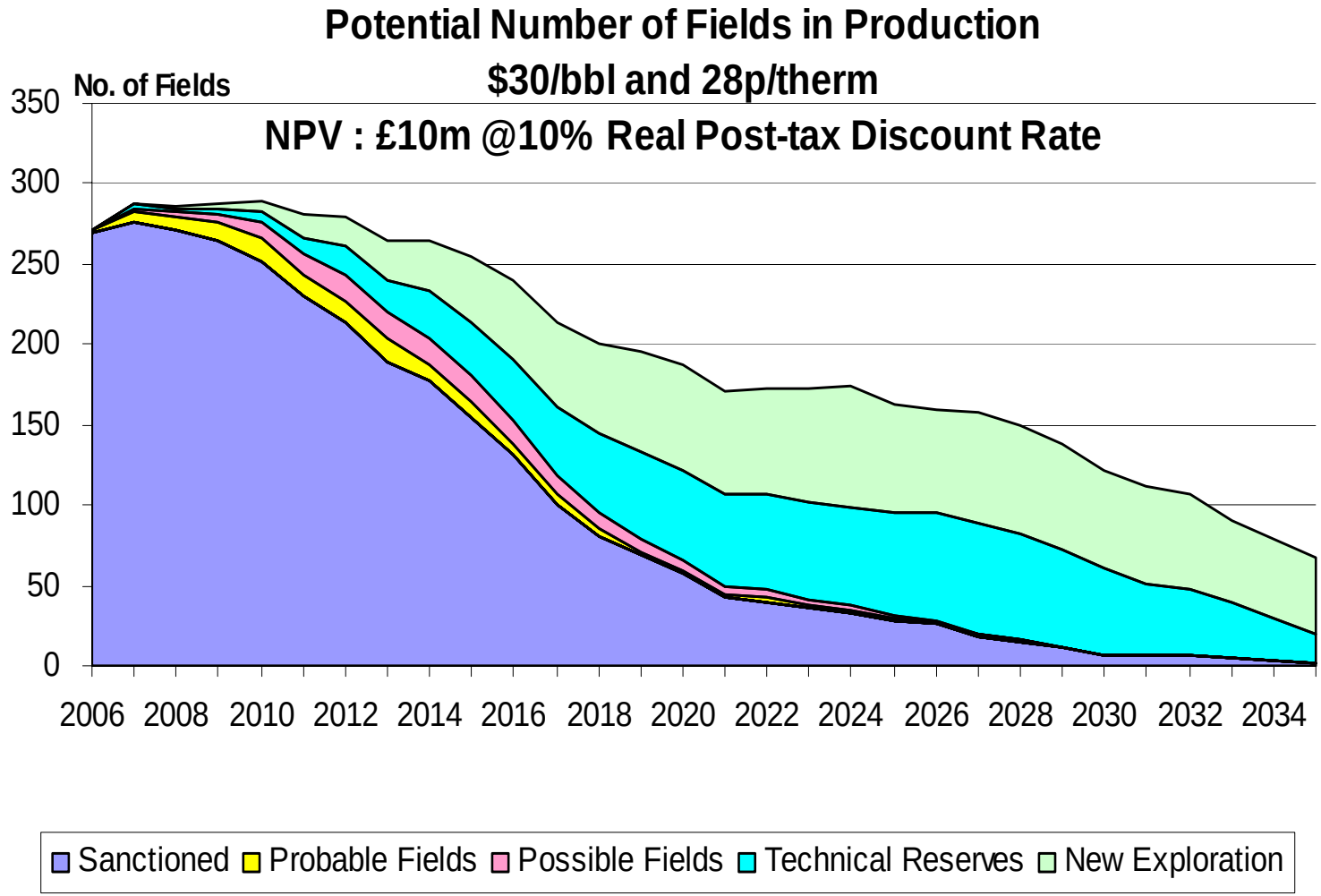

Potential Real NPV @ 10% Discount Rate
$25/bbl and 24p/therm (Post Budget)
No. of Fields/ Projects
140
120
100
80
60
40
20
0
NPV @ 10% < £0m
£0 to £5m
£5m to £10m
£10m to £15m
£15m to £20m
£20m to £60m
£60m to £100m
£100m to £200m
£200m to £500m
> £500m
NPV Ranges (£m 2006)
Probable Incremental
Possible Incremental
Future Probable
Future Possible
Technical Reserves
New Exploration



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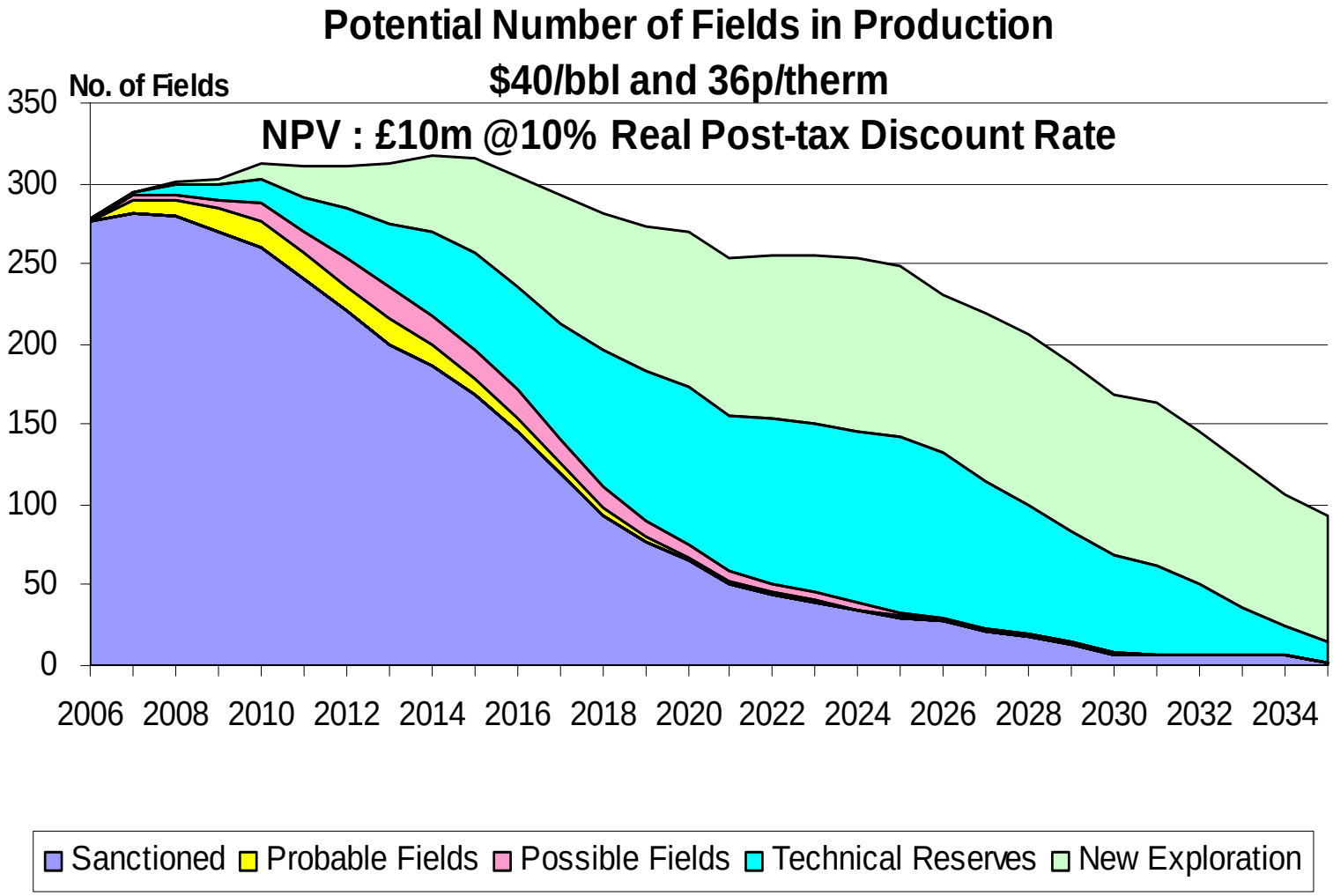

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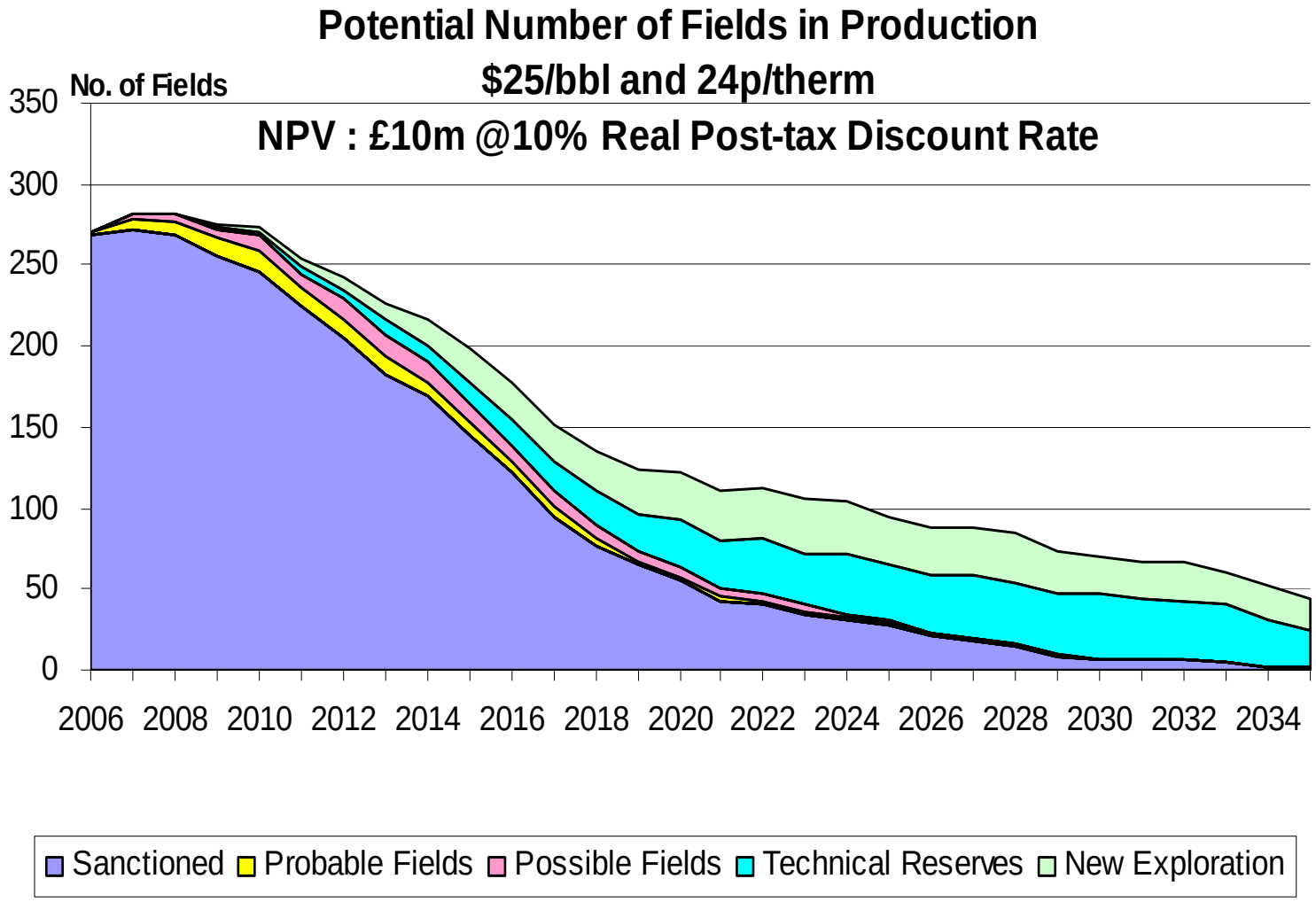

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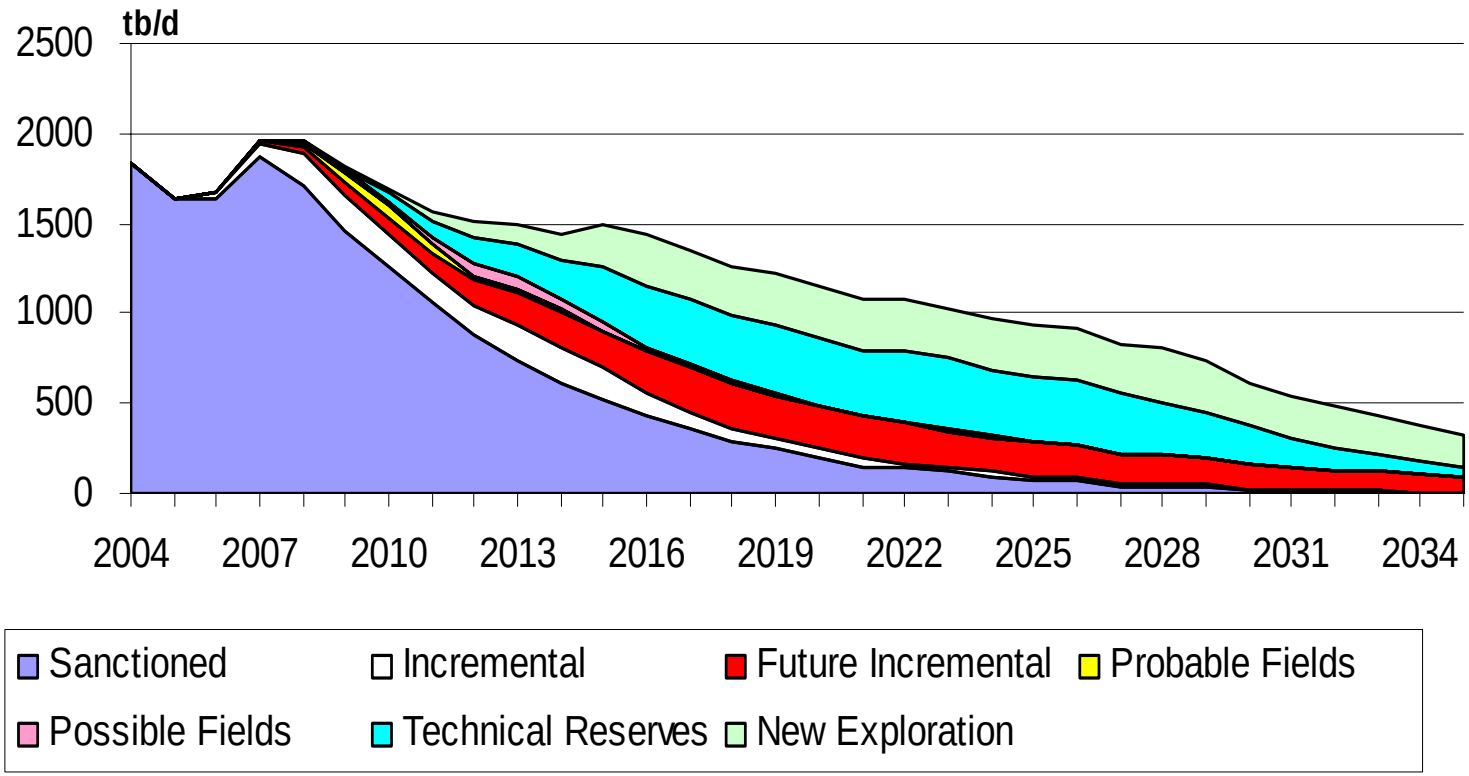
Potential Oil Production
$30/bbl and 28p/therm
NPV : £10m @10% Real Post-tax Discount Rate



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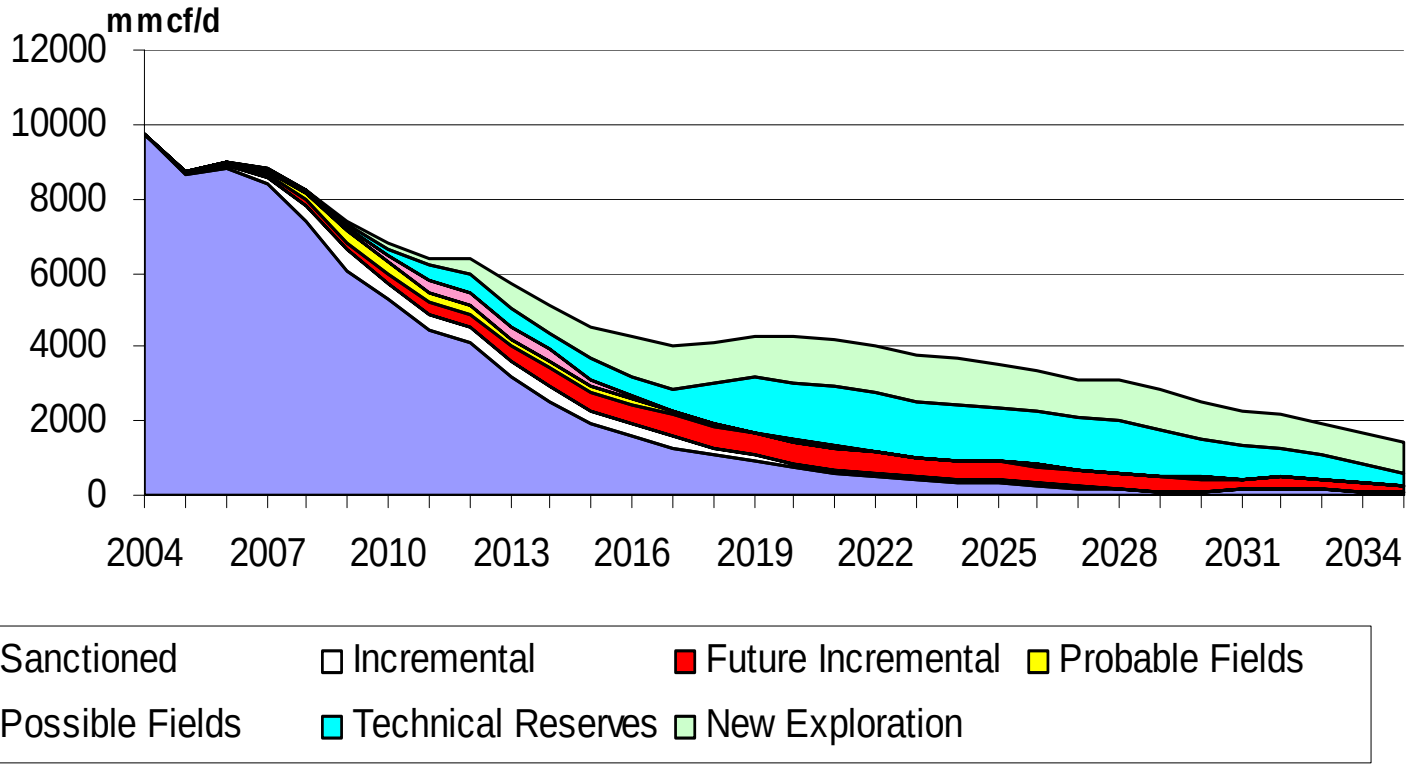
Potential Gas Production
$30/bbl and 28p/therm
NPV : £10m @10% Real Post-tax Discount Rate



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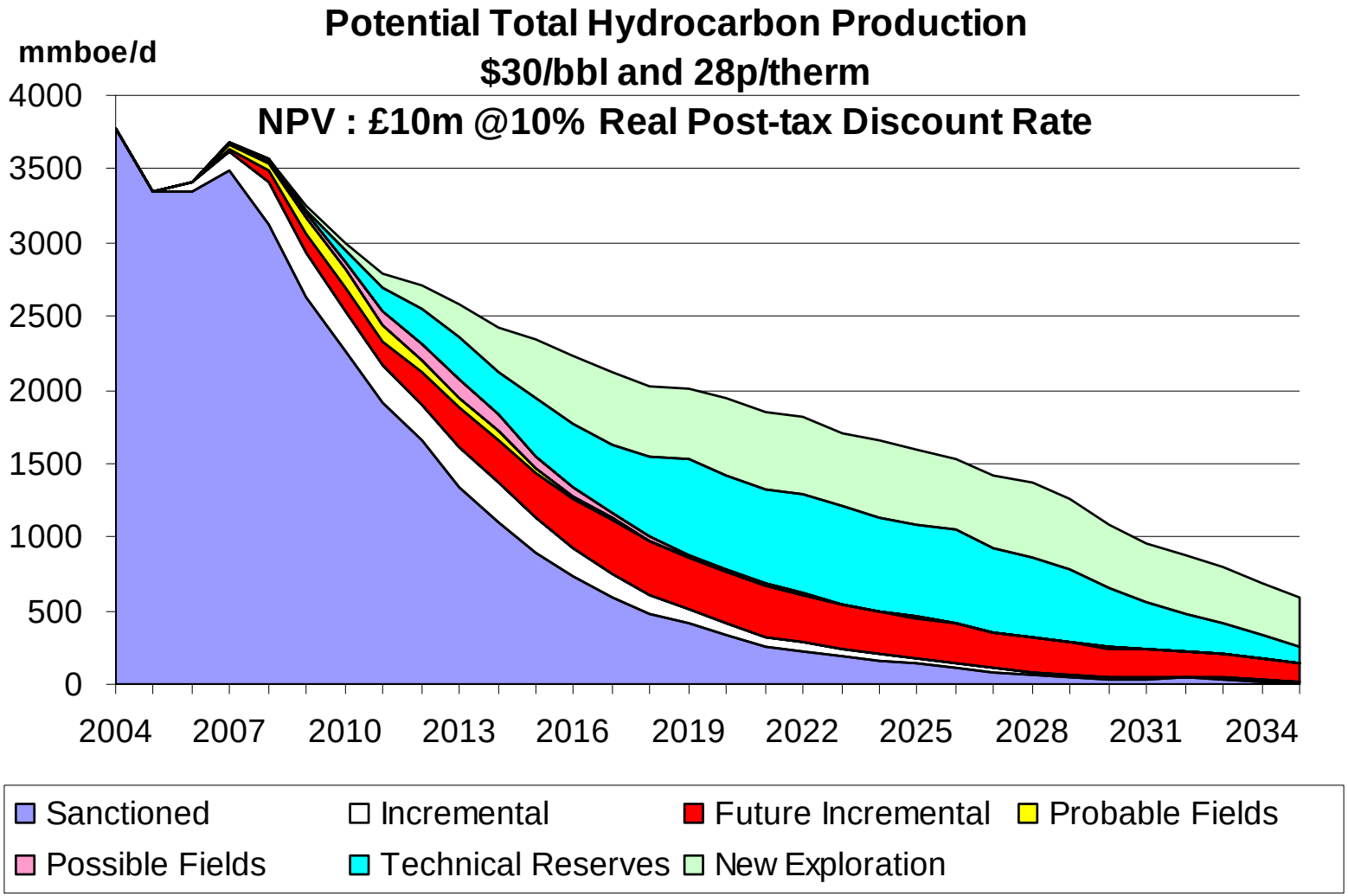

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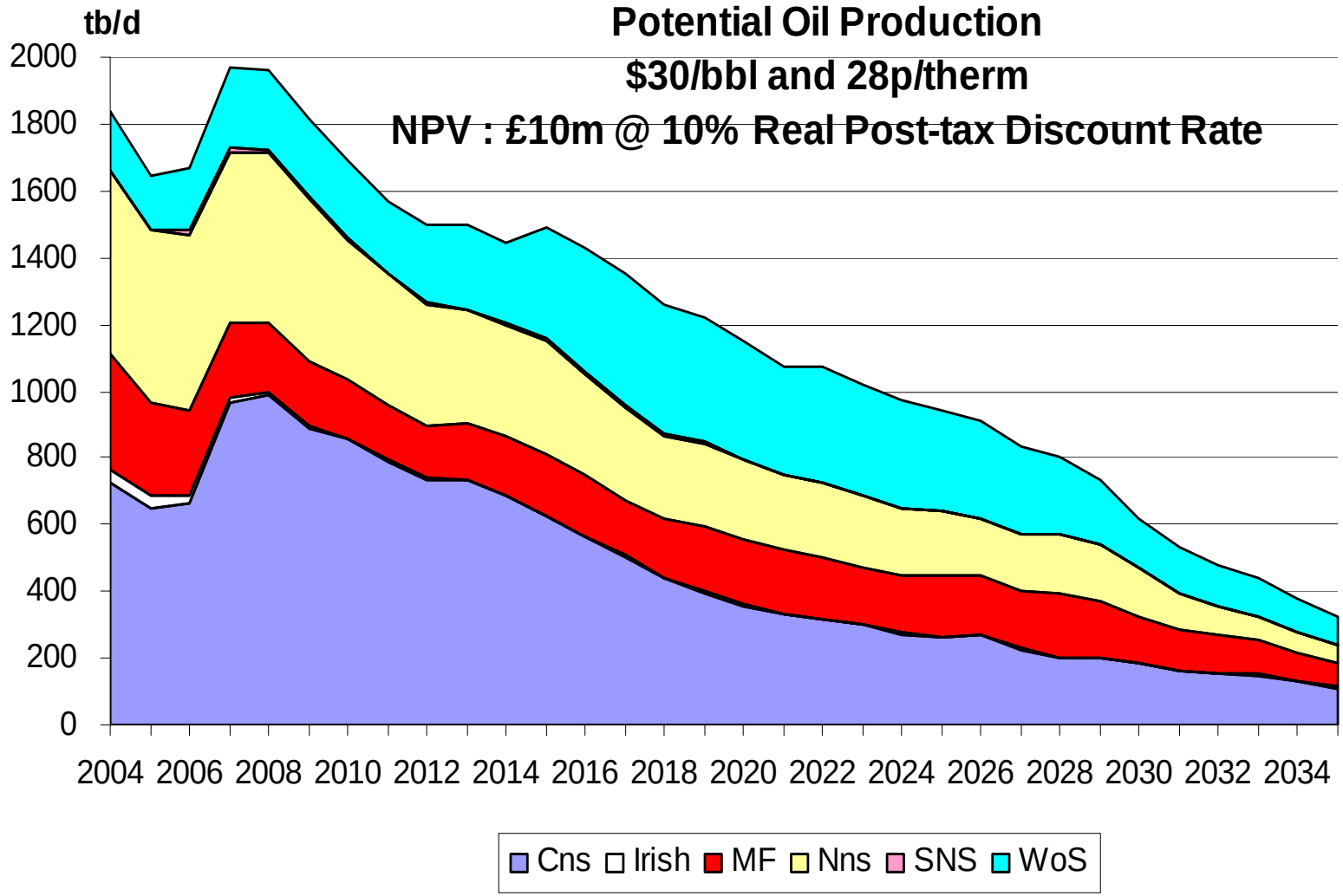

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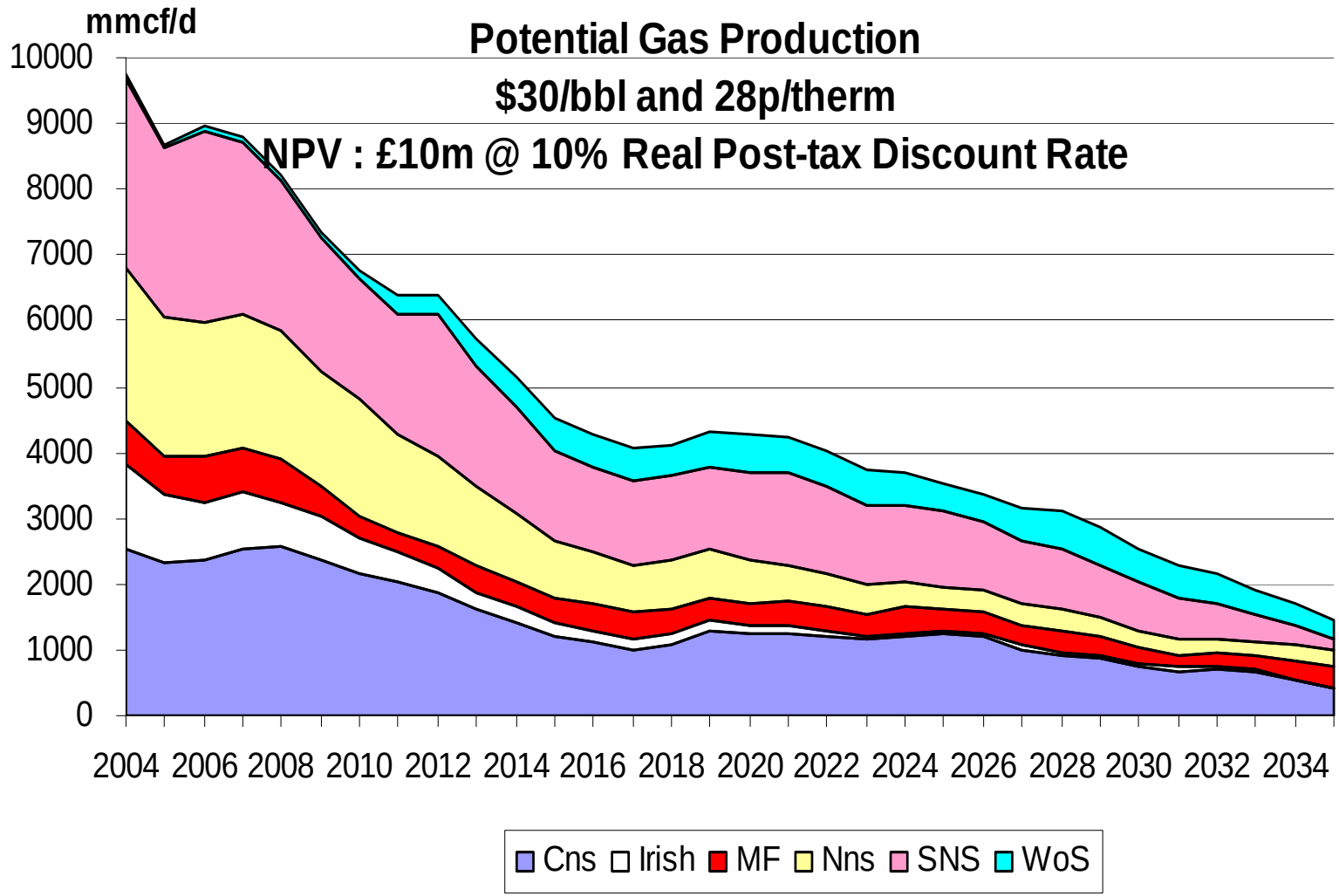

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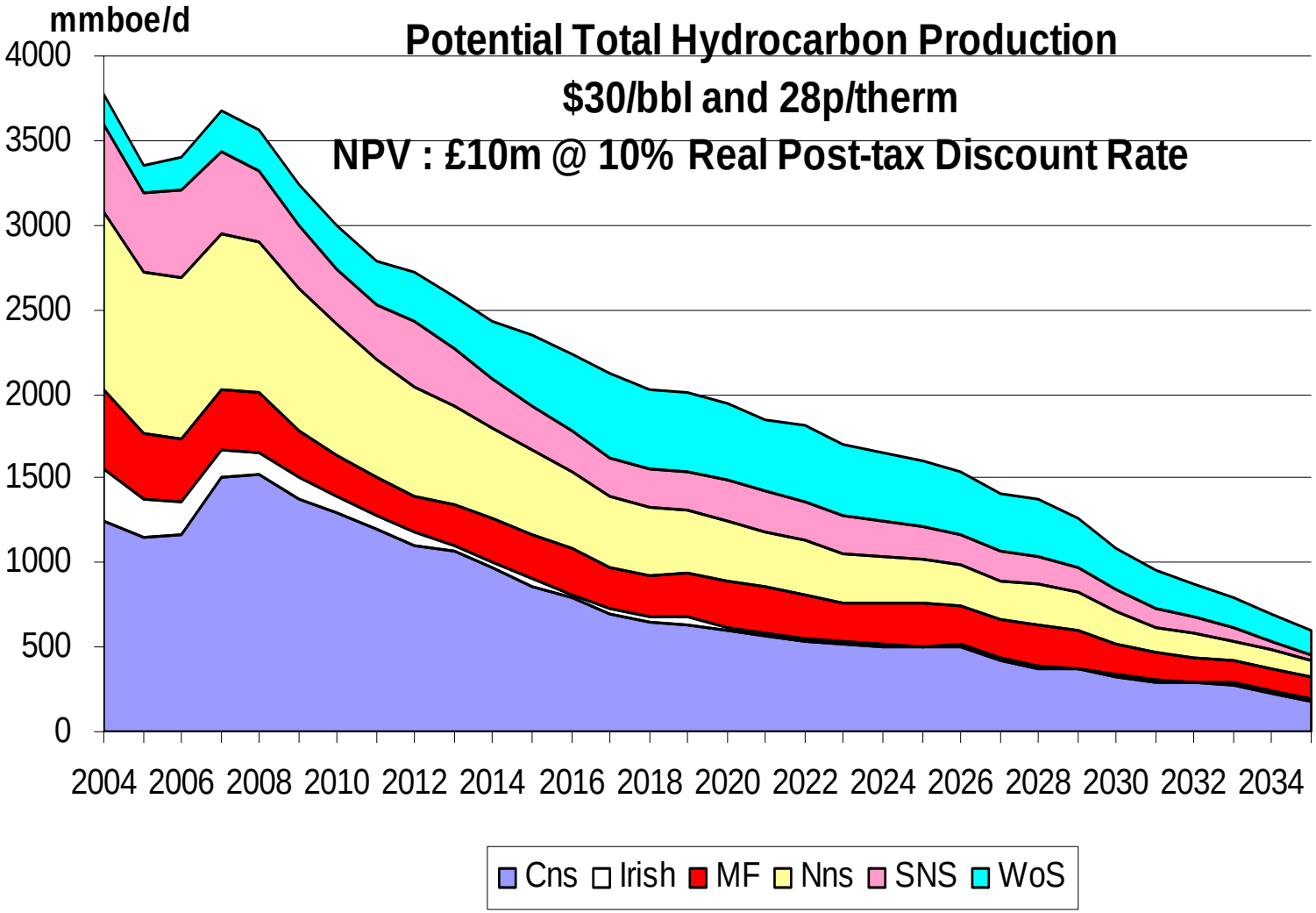

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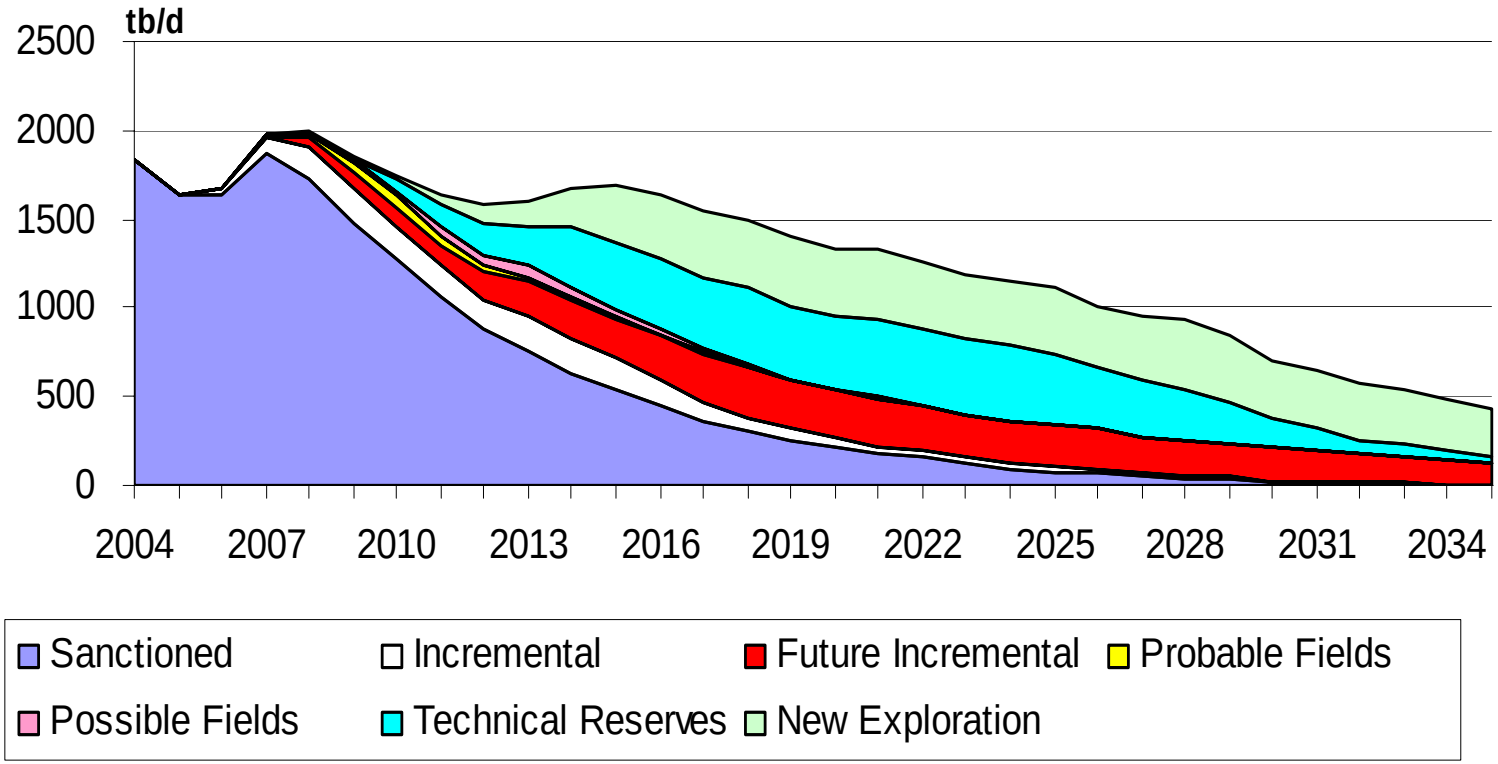
Potential Oil Production
$40/bbl and 36p/therm
NPV : £10m @10% Real Post-tax Discount Rate



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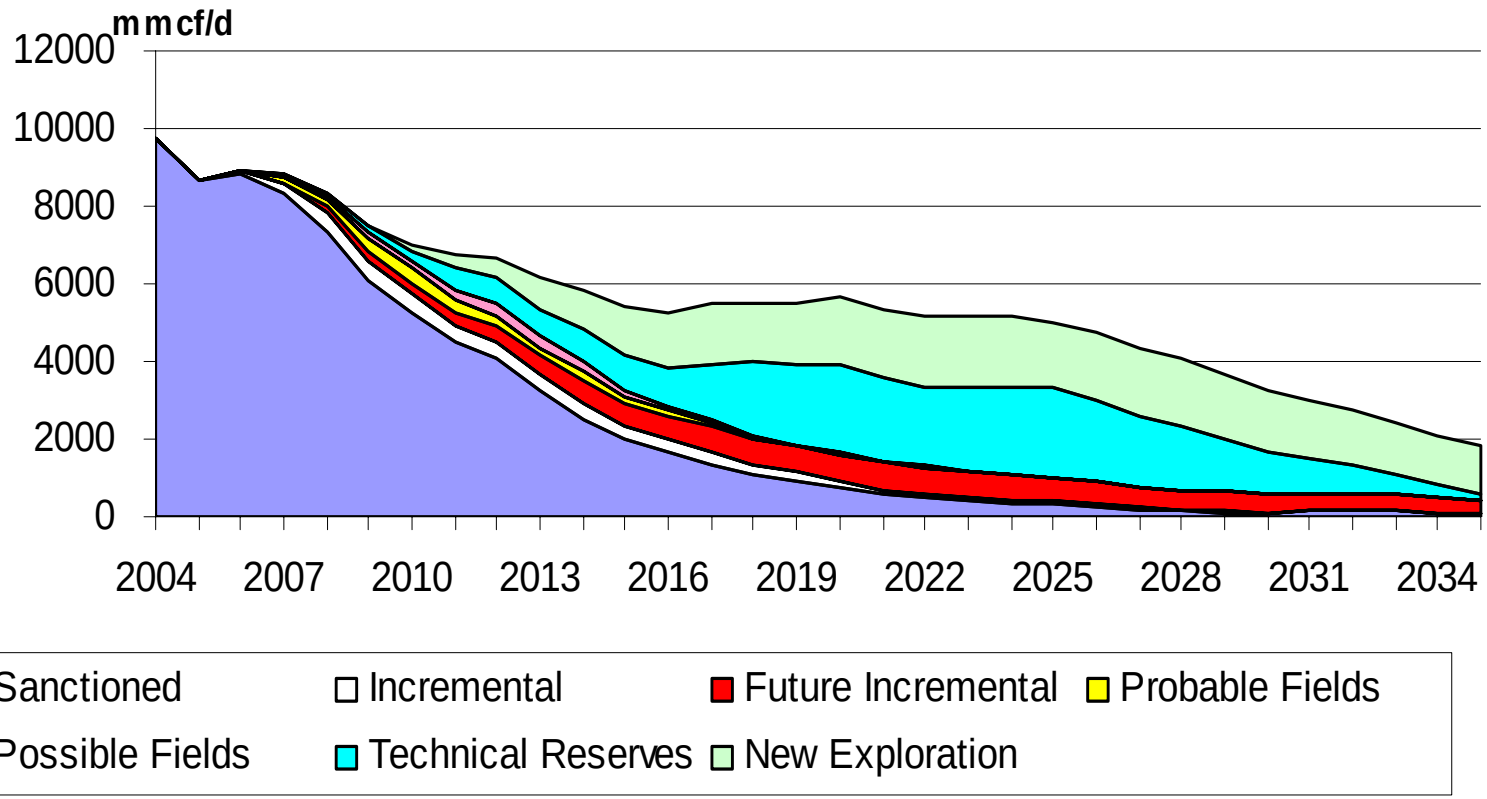

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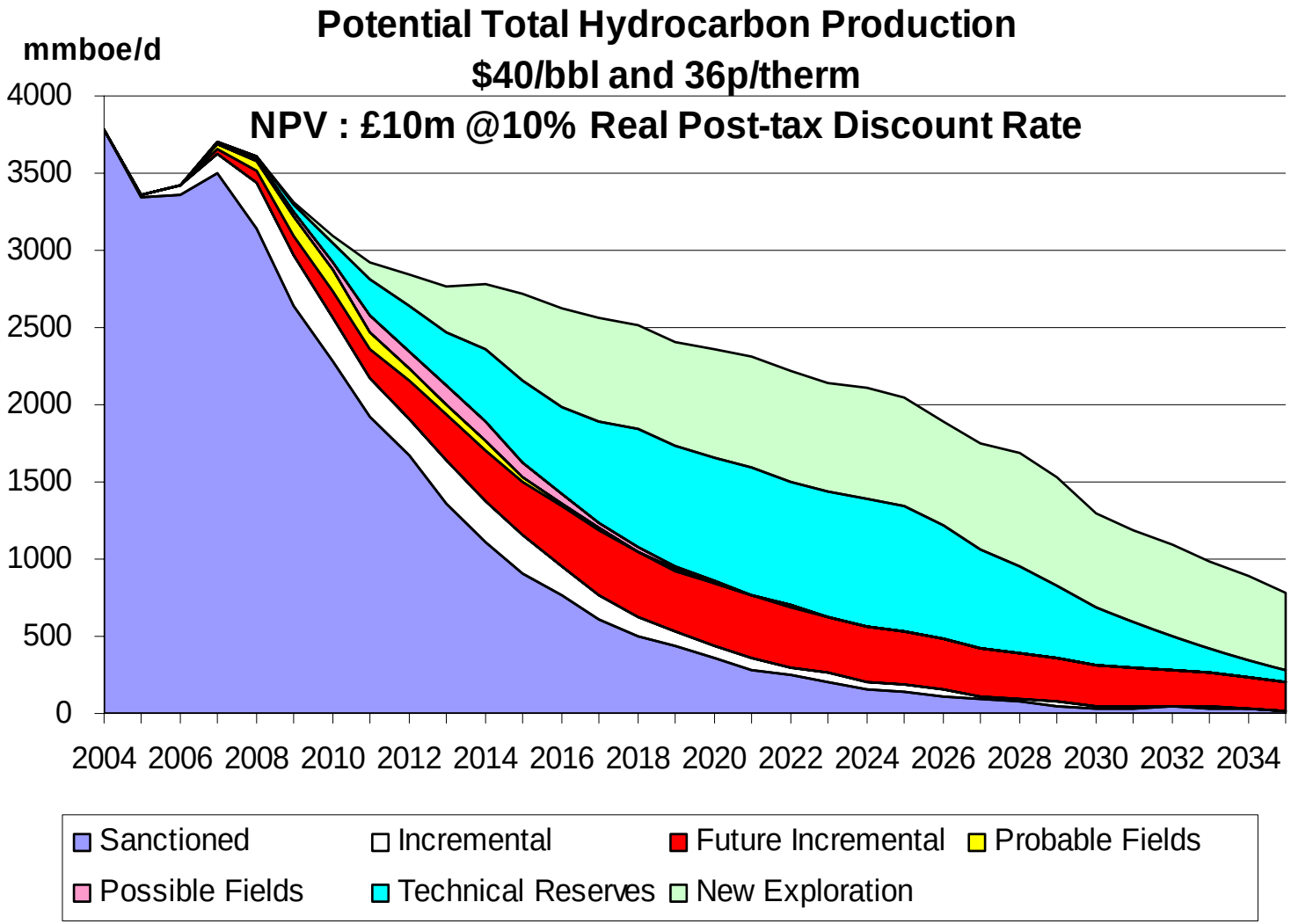

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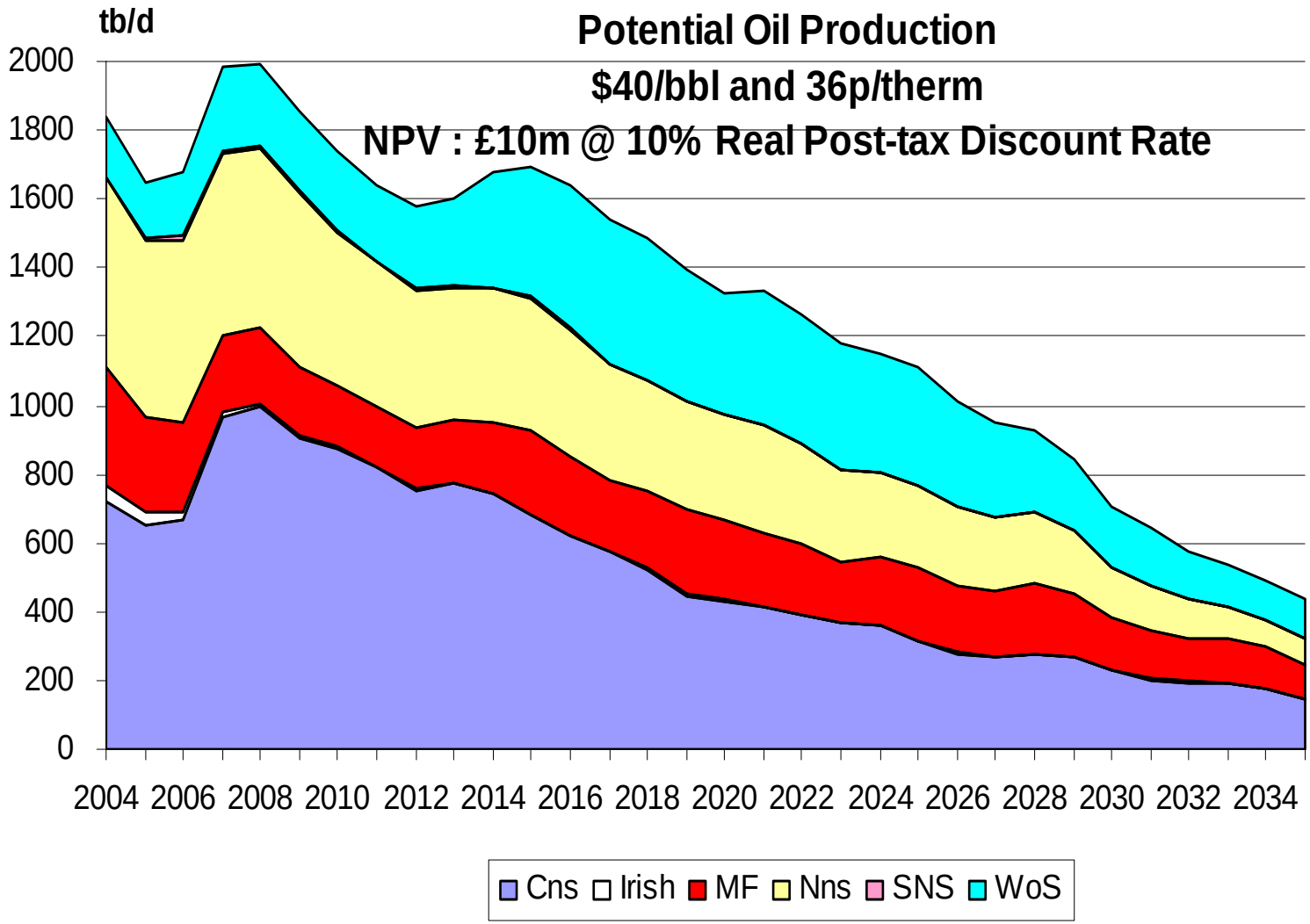

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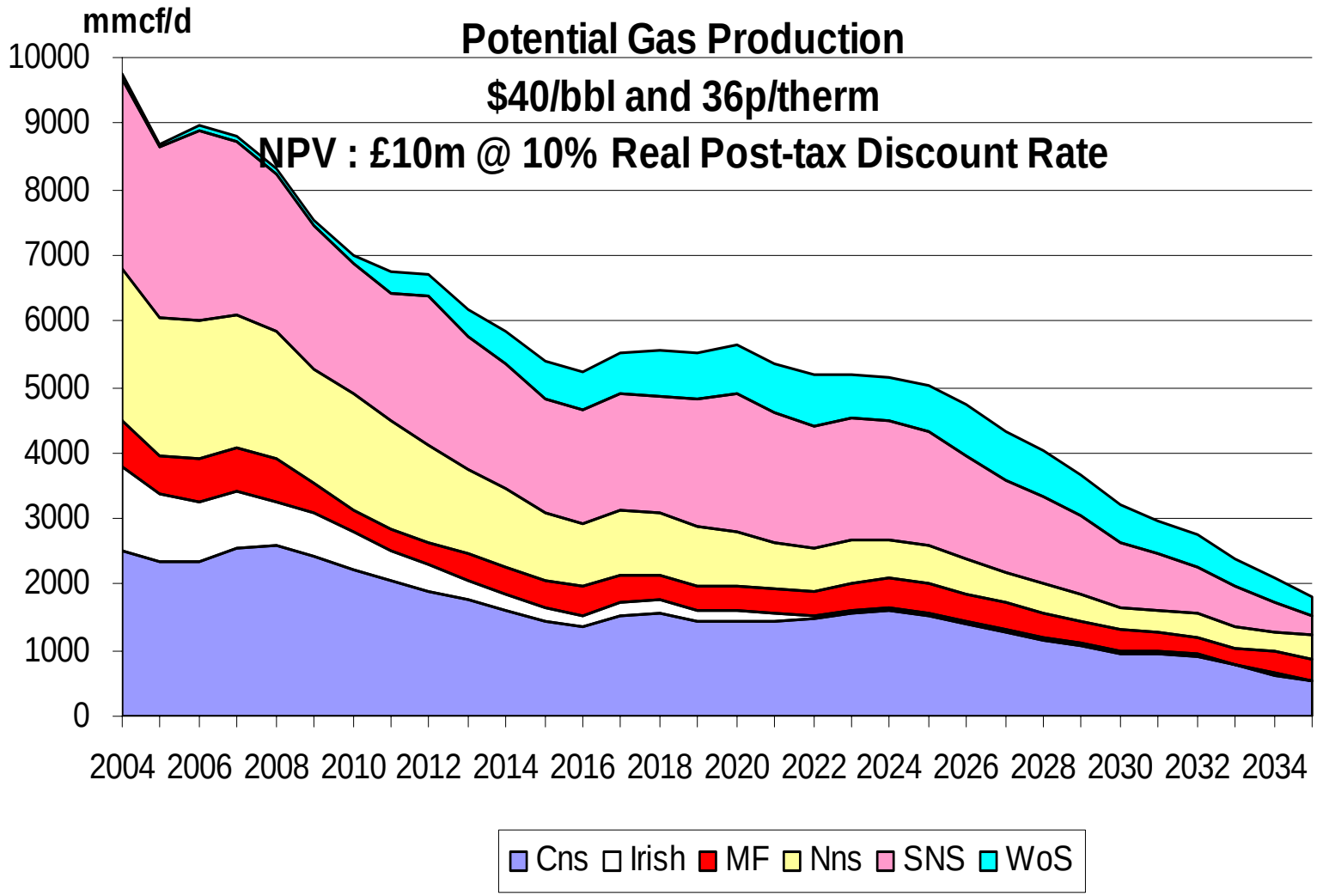

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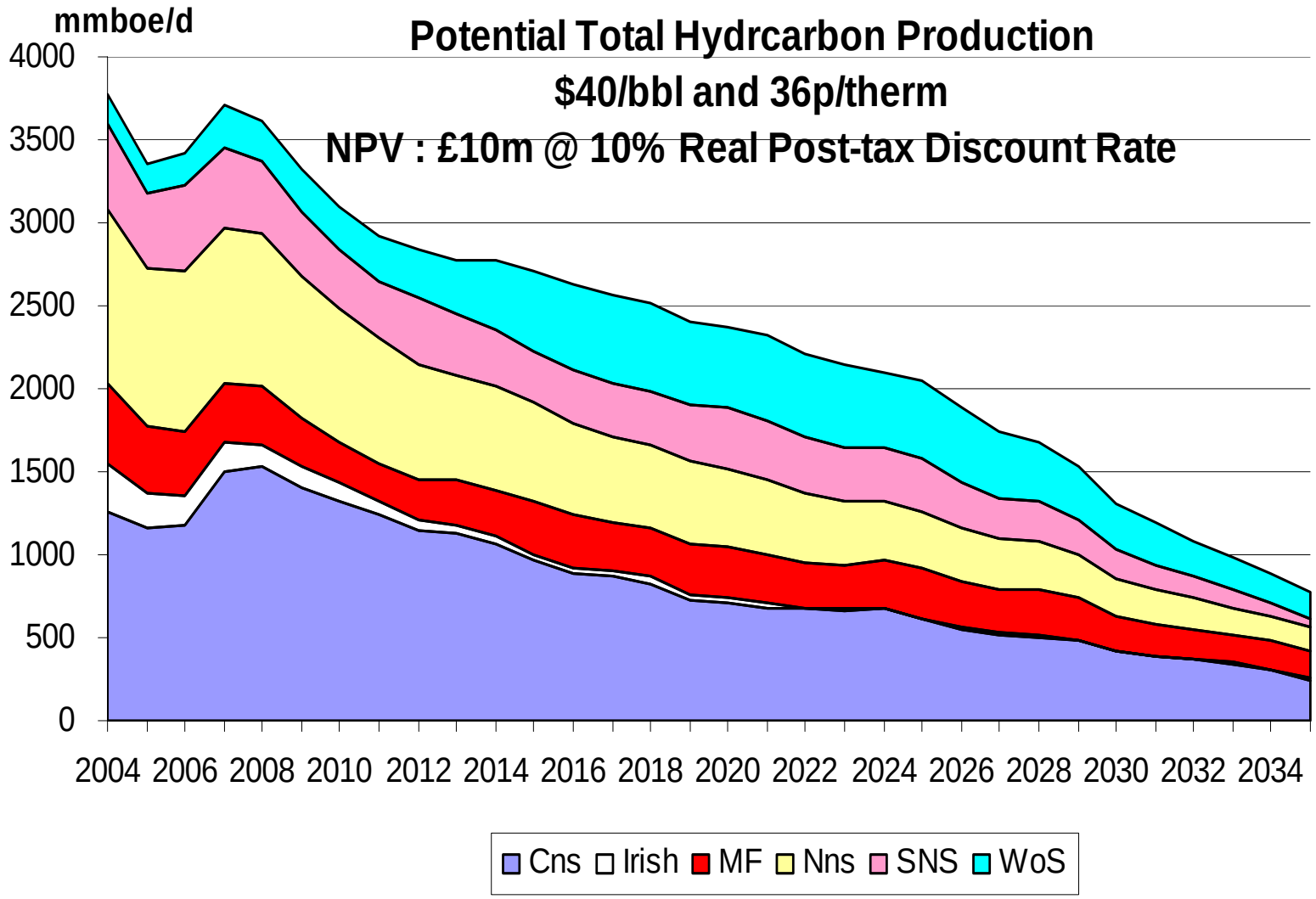

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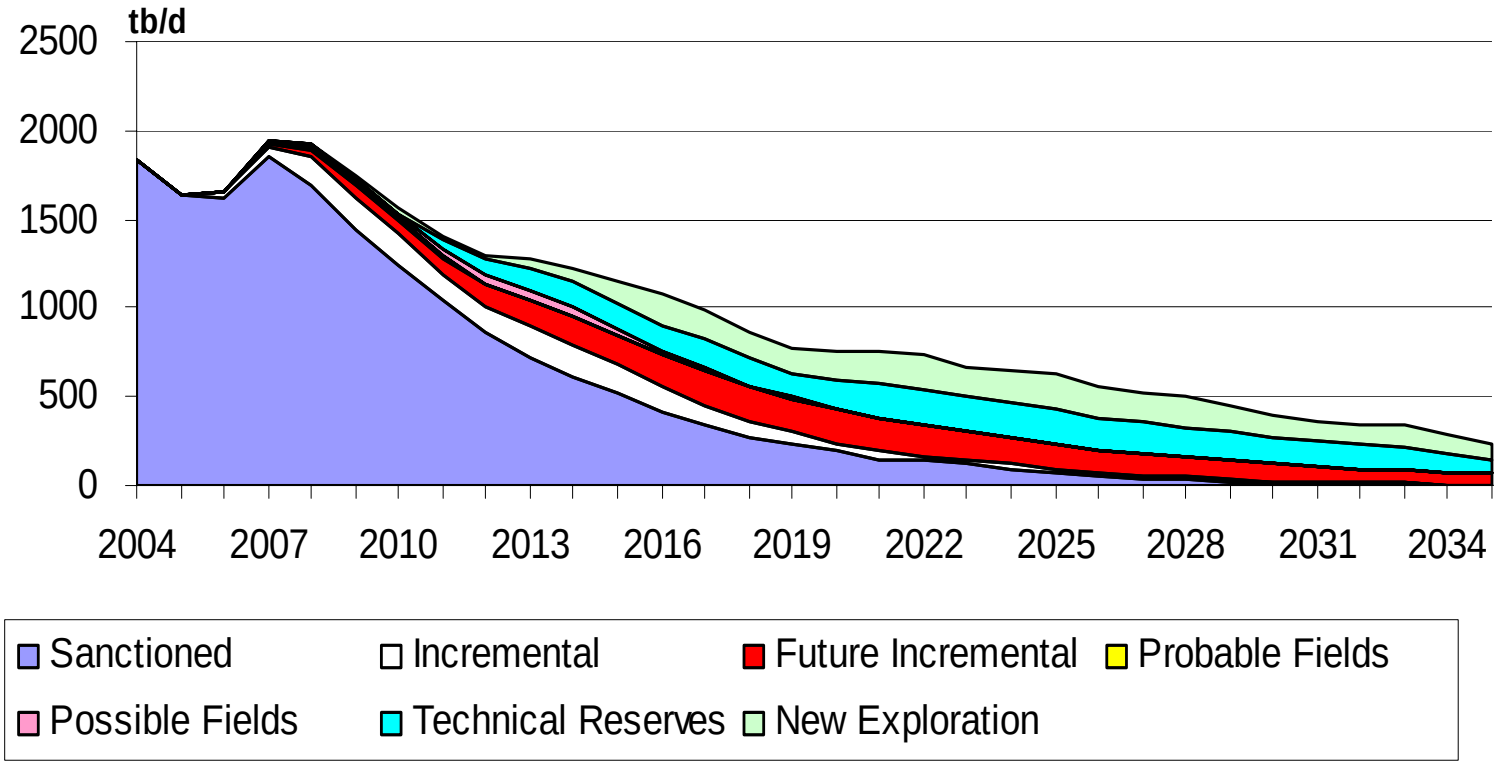
Potential Oil Production
$25/bbl and 24p/therm
NPV : £10m @10% Real Post-tax Discount Rate



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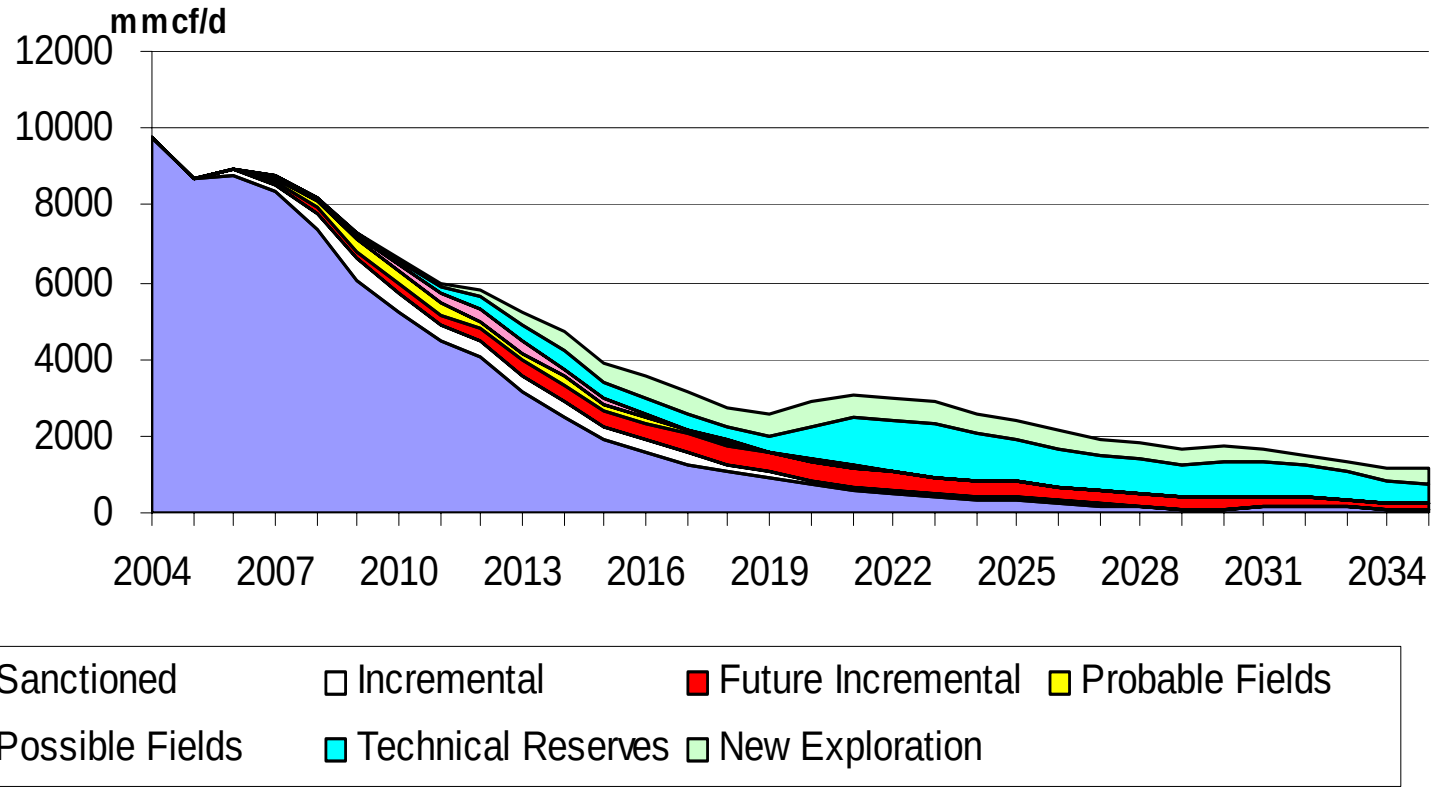
Potential Gas Production
$25/bbl and 24p/therm
NPV : £10m @10% Real Post-tax Discount Rate



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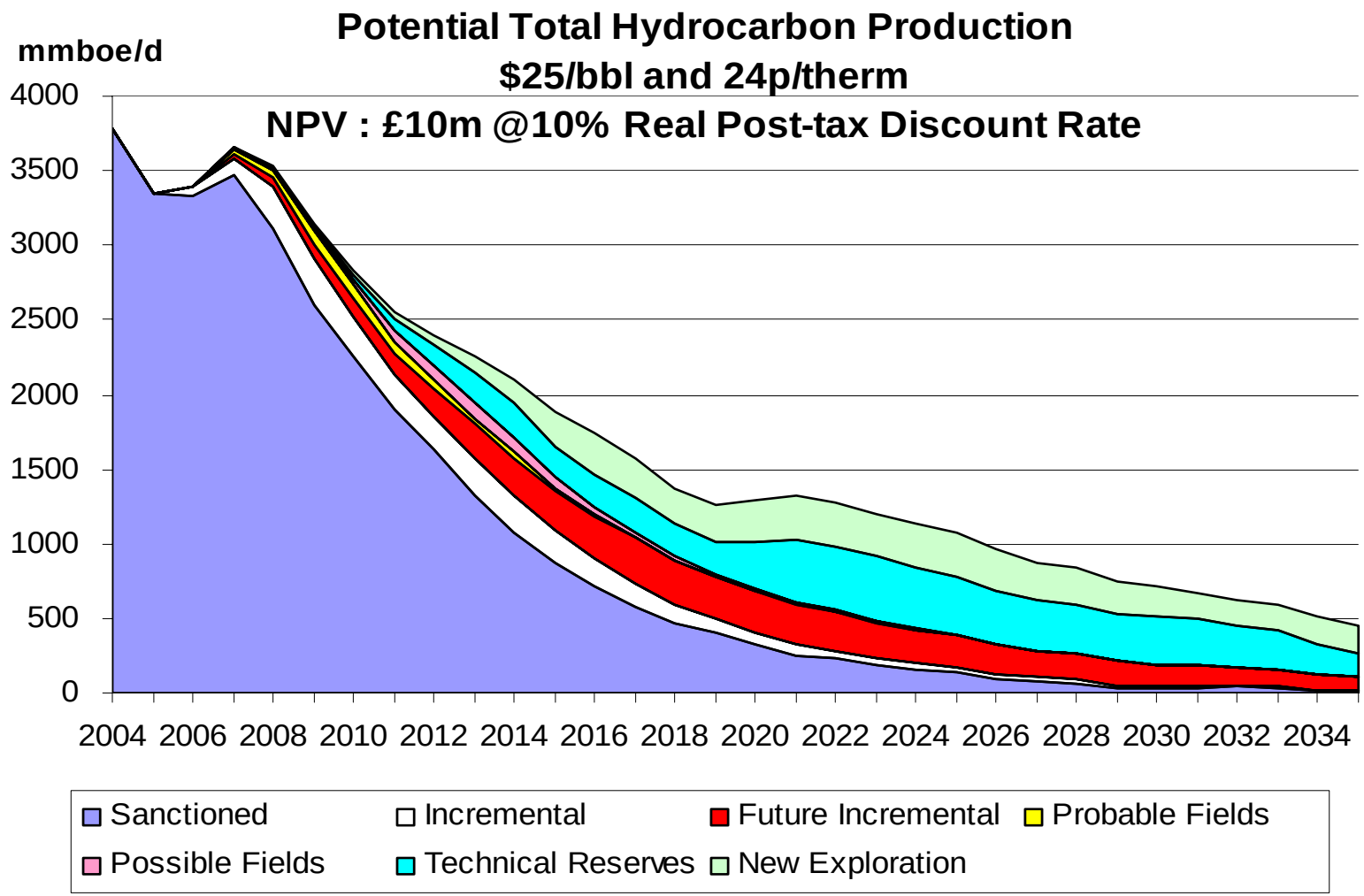

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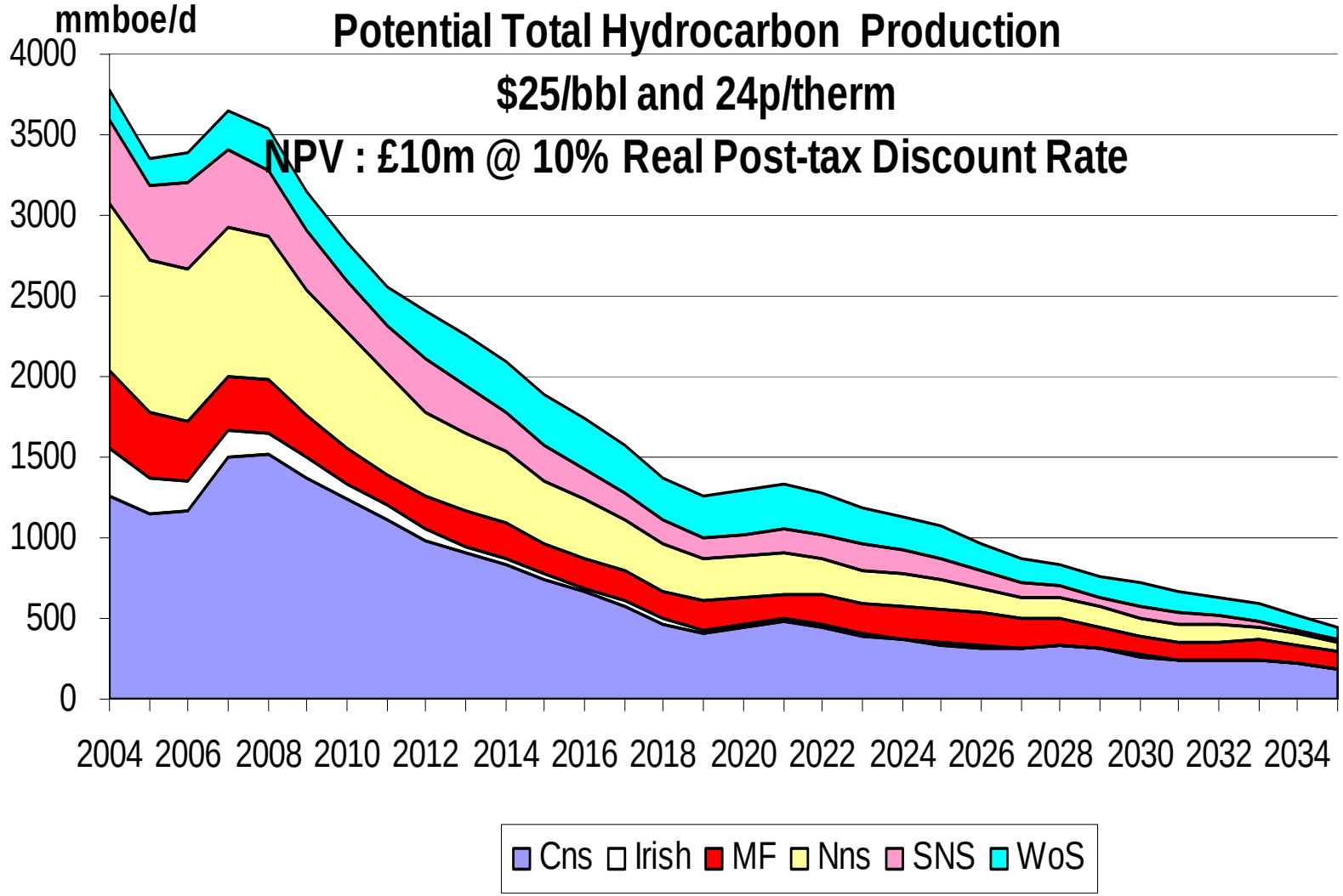

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Cumulative Potential Production from 2006 to 2020 (bn boe)

Sanctioned		Current Incremental	Future Incremental (all fields)	Probable (excluding incremental)	Possible (excluding incremental)	Technical Reserves (excluding incremental)	New Exploration (excluding incremental)	Aggregate (rounded)
$25 24p	8.8	1.0	1.0	0.2	0.2	0.76	0.72	12.8
$30 28p	8.9	1.1	1.2	0.3	0.3	1.5	1.3	14.6
$40 36p	9.0	1.1	1.4	0.3	0.3	2.1	1.8	15.9

Cumulative Potential Production from 2006 to 2035 (bn boe)

Sanctioned		Current Incremental	Future Incremental (all fields)	Probable (excluding incremental)	Possible (excluding incremental)	Technical Reserves (excluding incremental)	New Exploration (excluding incremental)	Aggregate (rounded)
$25 24p	9.3	1.2	2.0	0.20	0.25	2.6	2.0	17.5
$30 28p	9.4	1.2	2.5	0.27	0.3	4.1	3.8	21.6
$40 36p	9.5	1.25	3.0	0.28	0.3	4.85	5.4	24.6

Conclusions

1. Substantial remaining potential.
2. Pilot target of 3 mmboe/d in 2010 is challenging (as is 2 mmboe/d in 2020).
3. Attainment of longer term potential depends on Success of Pilot/DTI initiatives relating to:
   a. Fallow fields/blocks
   b. Infrastructure code of practice
   c. Brownfields (including stewardship)
   d. Facilitation of asset transactions including decommissioning liability problem
4. Prolongation of infrastructure life needed for development of fields in long term.

5. Specific Incentives:

a) Remove SC on income from new tariff contracts as was done for PRT.

b) Reduce discrimination against new players by increasing interest rate on unused allowances to reflect cost of capital.

c) Encourage tertiary recovery. Little undertaken currently. Tax credit against SC for R and D element.

d) Reduce investment uncertainty relating to major tax changes. SC rate related to oil price.