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**The Investment Allowance in the Wider
Context of the UK Continental Shelf in 2015:
A Response to the Treasury Consultation**

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and
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February, 2015

**Aberdeen Centre for Research in Energy Economics and
Finance (ACREEF)**

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NORTH SEA ECONOMICS

Research in North Sea Economics has been conducted in the Economics Department since 1973. The present and likely future effects of oil and gas developments on the Scottish economy formed the subject of a long term study undertaken for the Scottish Office. The final report of this study, The Economic Impact of North Sea Oil on Scotland, was published by HMSO in 1978. In more recent years further work has been done on the impact of oil on local economies and on the barriers to entry and characteristics of the supply companies in the offshore oil industry.

The second and longer lasting theme of research has been an analysis of licensing and fiscal regimes applied to petroleum exploitation. Work in this field was initially financed by a major firm of accountants, by British Petroleum, and subsequently by the Shell Grants Committee. Much of this work has involved analysis of fiscal systems in other oil producing countries including Australia, Canada, the United States, Indonesia, Egypt, Nigeria and Malaysia. Because of the continuing interest in the UK fiscal system many papers have been produced on the effects of this regime.

From 1985 to 1987 the Economic and Social Science Research Council financed research on the relationship between oil companies and Governments in the UK, Norway, Denmark and The Netherlands. A main part of this work involved the construction of Monte Carlo simulation models which have been employed to measure the extents to which fiscal systems share in exploration and development risks.

Over the last few years the research has examined the many evolving economic issues generally relating to petroleum investment and related fiscal and regulatory matters. Subjects researched include the economics of incremental investments in mature oil fields, economic aspects of the CRINE initiative, economics of gas developments and contracts in the new market situation, economic and tax aspects of tariffing, economics of infrastructure cost sharing, the effects of comparative petroleum fiscal systems on incentives to develop fields and undertake new exploration, the oil price responsiveness of the UK petroleum tax system, and the economics of decommissioning, mothballing and re-use of facilities. This work has been financed by a group of oil companies and Scottish Enterprise, Energy. The work on CO₂ Capture, EOR and storage was financed by a grant from the Natural Environmental Research Council (NERC) in the period 2005 – 2008.

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The Investment Allowance in the Wider Context of
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Professor Alexander G. Kemp and Linda Stephen

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The Investment Allowance in the Wider Context of
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1. Context

The UK Continental Shelf (UKCS) was exhibiting the problems of maturity well before the oil price collapse in the second half of 2014. The Wood Review published in February 2014 provided an incisive diagnostic analysis of the issues. The oil price collapse has compounded the problems facing the sector. The industry has been experiencing a net cash flow negative situation since 2013. At current prices the prospective returns on some – perhaps many – investments in new fields, projects and exploration can be unattractive even on a pre-tax basis.

In these circumstances major changes are required to ensure that the industry has a substantial long term future. The Wood Review argued that such major changes were required before the price collapse. They are clearly more pressing in current market conditions. The present paper is in response to the consultation on the proposed Investment Allowance for Supplementary Charge (SC). It was felt that the possible effects of this allowance on activity levels should be seen within the context of other possible changes which are currently being discussed. The paper thus examines in turn the effects of (1) the Investment Allowance, (2) cost savings made by the industry, and (3) a reduction in the rate of SC. The paper also shows the combined effects of these measures. Other tax

reform measures (for example, to PRT) are also desirable and will be examined in a subsequent paper.

2. Methodology and Assumptions

The research has been conducted with the employment of a large financial model incorporating all the historic and current tax terms. A large field database including sanctioned fields, probable and possible fields, technical reserves, and future discoveries, as well as incremental projects has been used to project activity levels under different assumptions regarding oil and gas prices, investment hurdles, exploration effort and success rates, and costs of future fields. A detailed discussion of these assumptions is available in a recent paper, A. G. Kemp and L. Stephen, “Price Sensitivity, Capital Rationing and Future Activity in the UK Continental Shelf after the Wood Review”, (November 2014), North Sea Study Occasional Paper No. 130 (<http://www.abdn.ac.uk/~pec144/acreef/>).

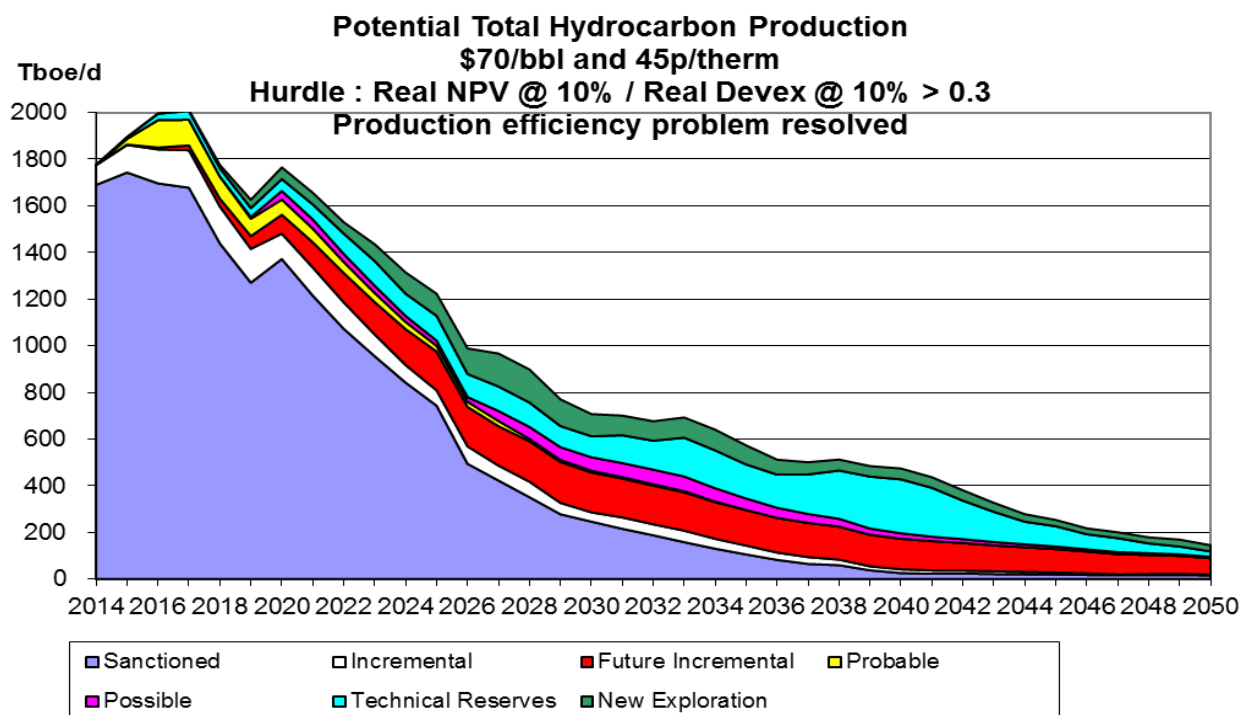
For the present study a relatively low future price scenario of \$70 per barrel and 45 pence per therm in real terms has been employed. The investment hurdle used is post-tax NPV @ 10% / pre-tax I @ 10%. The base case incorporates the current tax system with SC at 30% and the various field allowances for this tax being all those currently available. With respect to the Investment Allowance a rate of 62.5% has been employed in the modelling. In the base case the cost assumptions are those prevailing before any systematic cost reductions. In the cases where cost savings have taken place the assumption is that these amount to 15% across the board for both development and operating costs.

3. Results

(a) Base Case

As stated above the base case reflects the situation under the current tax system and before any cost reductions. In Chart 1 total hydrocarbon production is shown on the (optimistic) assumption that the production efficiency problem is substantially solved over the next few years. The long run brisk decline rate is a noticeable feature. The contributions of probable and possible fields and future discoveries are quite modest. Total cumulative production in the period 2014-2050 is 11.9 billion barrels of oil equivalent (bn boe). To put this in perspective DECC's best estimates of the remaining potential are in the range 11.1-21 bn boe.

Chart 1



In Charts 2 and 3 the field-related expenditures are shown. The steep fall from present levels is a noteworthy feature, particularly for development expenditures. The relatively small expenditures in future fields and incremental projects are another feature. Over the period to 2050 cumulative development expenditure is £81.4 billion (at 2014 prices), cumulative operating expenditures are £135 billion, and cumulative decommissioning expenditure £41.8 billion.

Chart 2

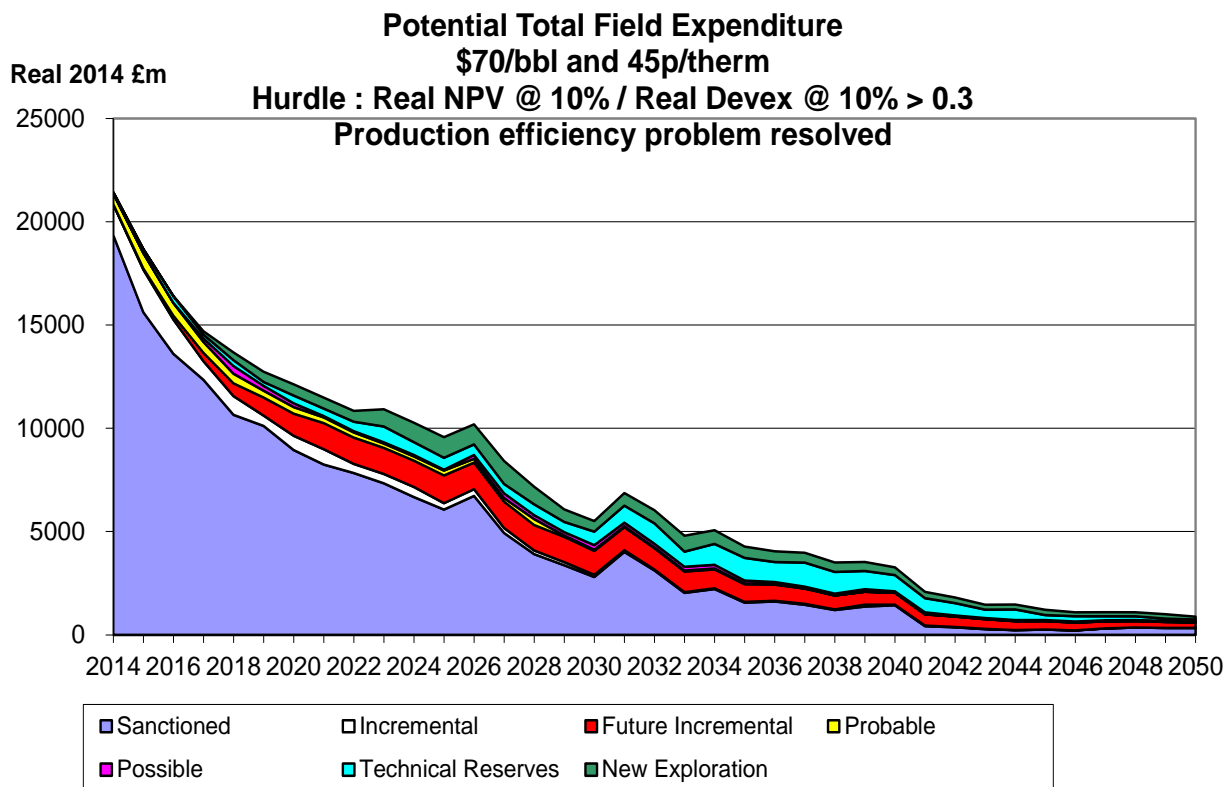
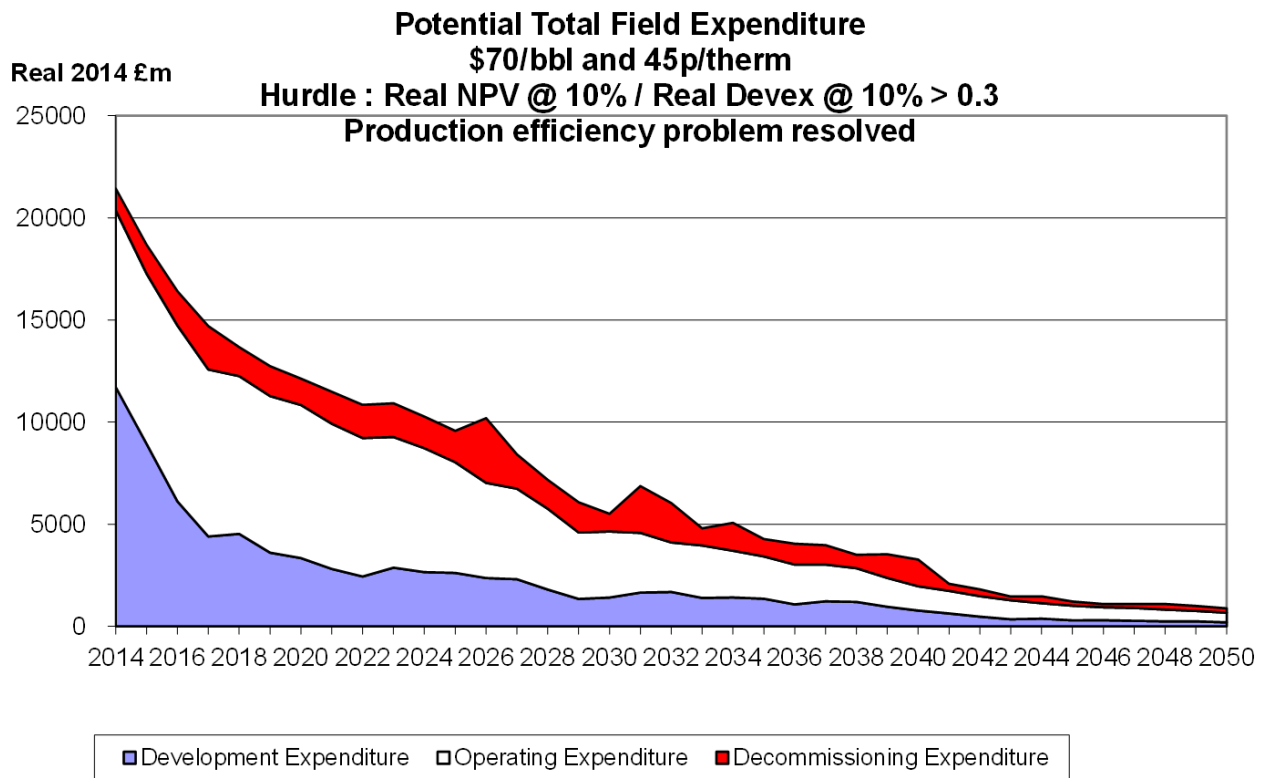


Chart 3



(b) Investment Uplift for SC at 62.5% on Unsanctioned Fields instead of Current Field Allowances

The changes from the base case of introducing the Investment Uplift for SC at the rate of 62.5% instead of current field allowances are now discussed. The changes in production are shown in Charts 4, 5, 6 and 7. The charts cover the period to 2040 but the modelling continues to 2050. Over the period to 2050 the increase in total hydrocarbon production is 703 mm boe. It is seen from Chart 4 that much of the increase comes in the period after 2020. There is an increase in cumulative field investment of £10 bn at 2014 prices (Chart 5), and an increase in cumulative operating costs of £7.1 bn (Chart 6). Decommissioning costs increase by £0.5 bn (Chart 7).

While significant, these increases from the introduction of the Investment Allowance are much less than those obtained from it at higher prices. With a \$90, 58 pence scenario it was found that cumulative hydrocarbon production to 2050 increased by 1.57 bn boe, with field investment increasing by £26.8 bn in the period. At the lower price many future projects are unprofitable on a pre-tax basis. An Investment Allowance of 62.5% by its own is unable to render viable large numbers of new projects.

Chart 4

Change in Potential Hydrocarbon Production
SCT 30% Uplift 62.5%
\$70/bbl and 45p/therm
Hurdle : Real NPV @ 10% / Real Devex @ 10% > 0.3

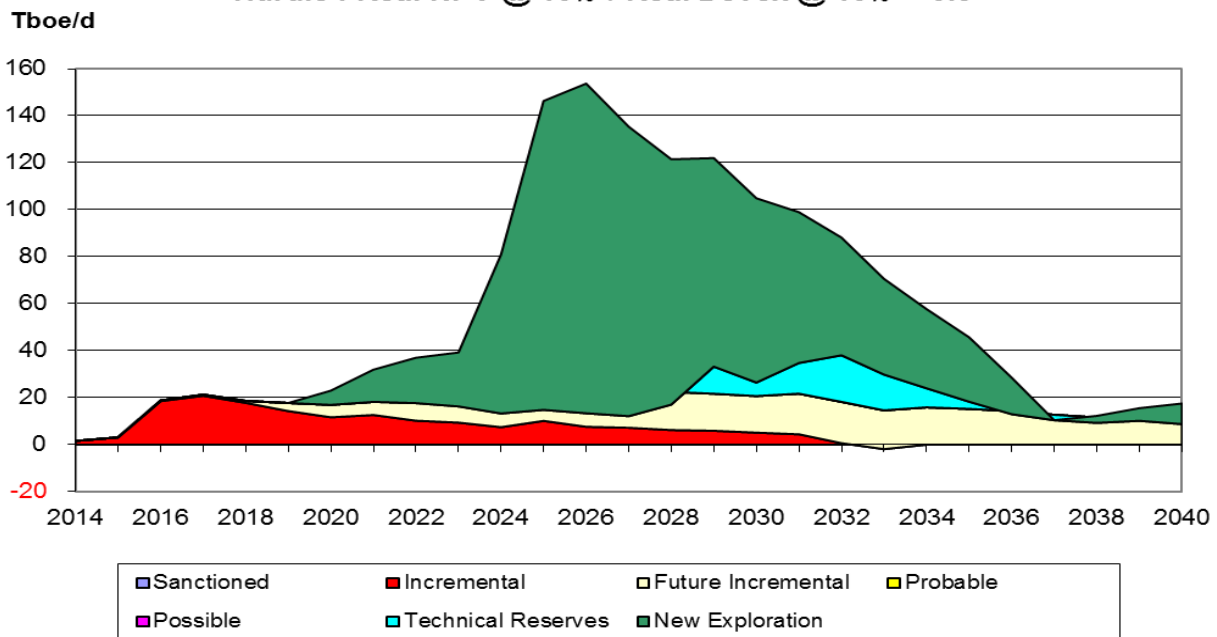


Chart 5

Change in Potential Development Expenditure
 SCT 30% Uplift 62.5%
 \$70/bbl and 45p/therm
 Hurdle : Real NPV @ 10% / Real Devex @ 10% > 0.3

Real 2014 £m

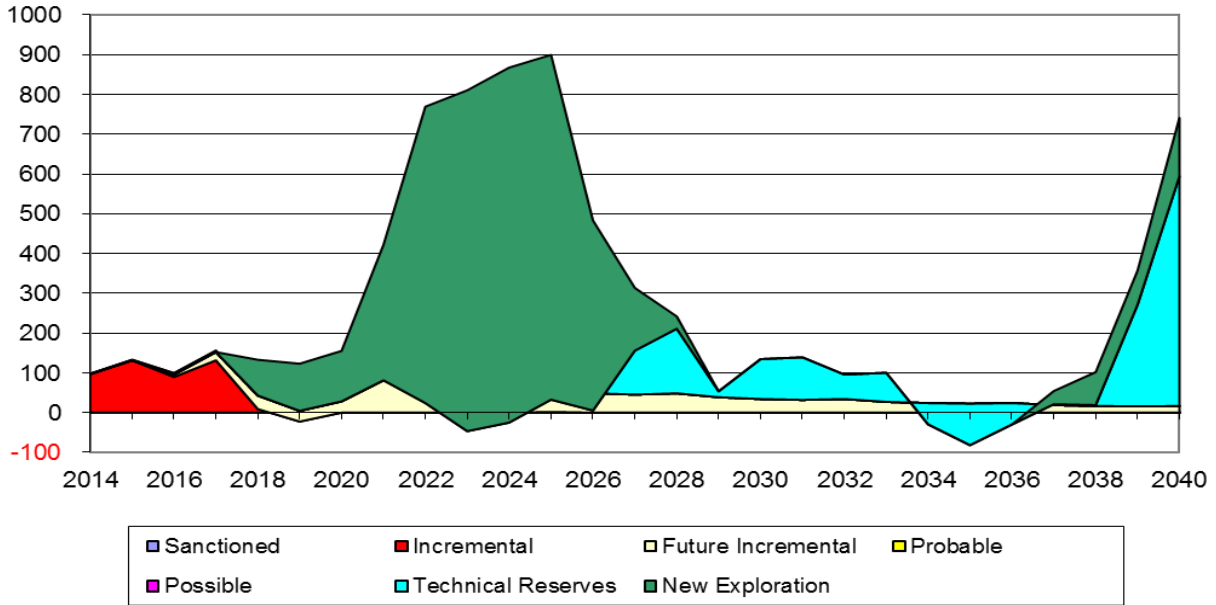


Chart 6

Change in Potential Operating Expenditure
 SCT 30% Uplift 62.5%
 \$70/bbl and 45p/therm
 Hurdle : Real NPV @ 10% / Real Devex @ 10% > 0.3

Real 2014 £m

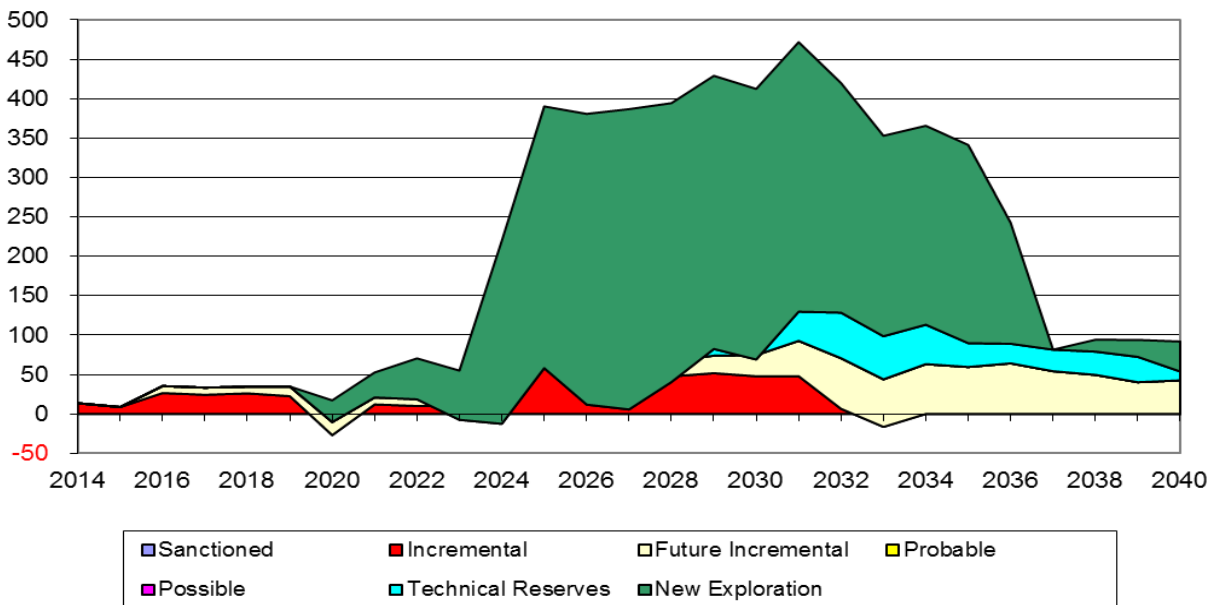
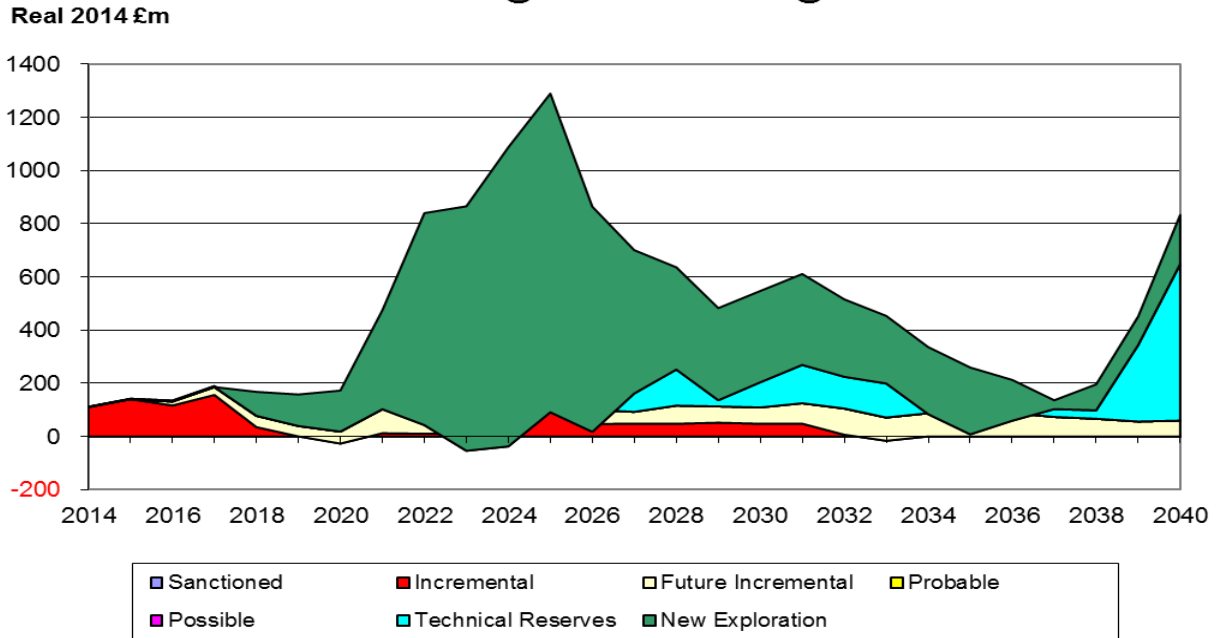


Chart 7

Change in Potential Total Expenditure
SCT 30% Uplift 62.5%
\$70/bbl and 45p/therm
Hurdle : Real NPV @ 10% / Real Devex @ 10% > 0.3



(c) Cost Savings of 15% for Development and Operating Expenditures

The effects of cost savings of 15% across the board are now examined, assuming no change to the tax system. In Chart 8 the change in total hydrocarbon production is shown. It is seen to be very substantial. In the period to 2050 the cumulative increase is 2.27 bn boe, producing a total recovery of 14.17 bn boe over the period. The cost savings of 15% across the board are sufficient to trigger the development of a large number of new fields and projects. It is noteworthy that the increase starts in the relatively near future and grows substantially to a peak around 2026.

Chart 8

Change in Potential Hydrocarbon Production
SCT 30% Devex and Opex reduced by 15%
\$70/bbl and 45p/therm
Hurdle : Real NPV @ 10% / Real Devex @ 10% > 0.3

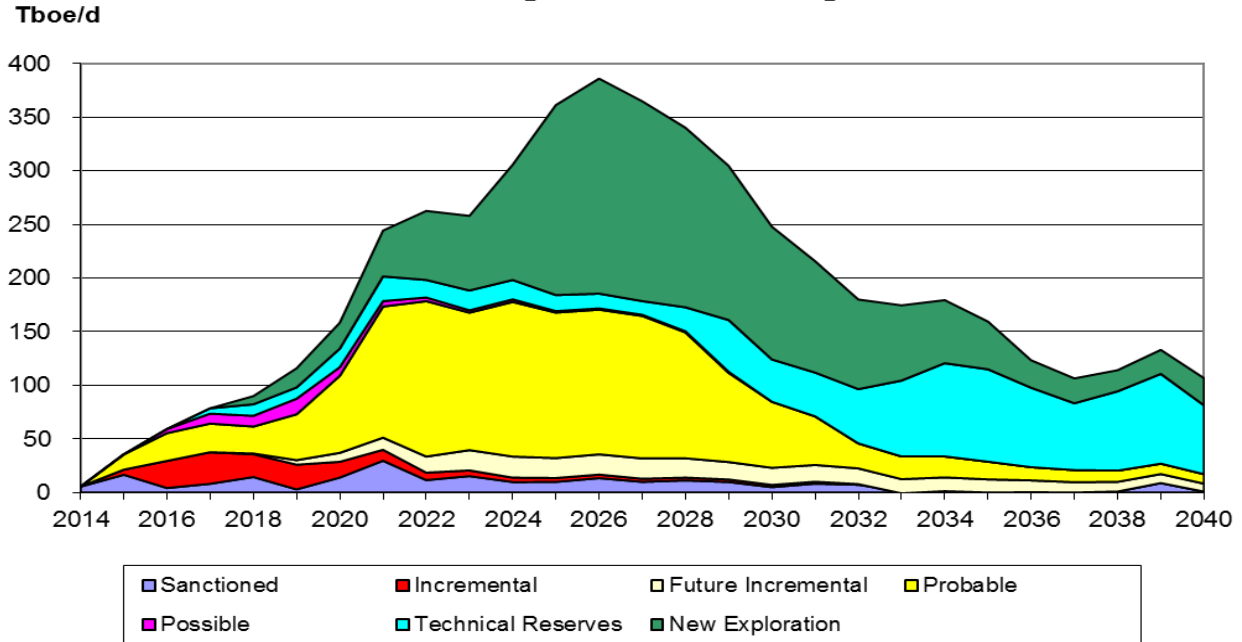
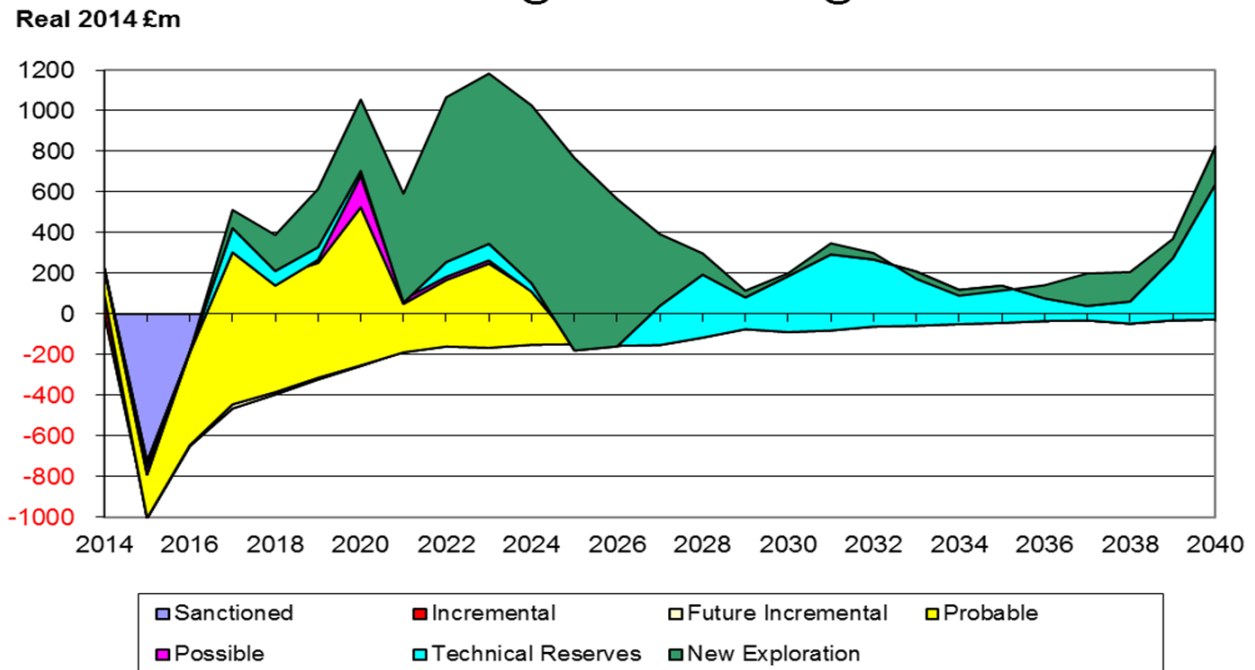


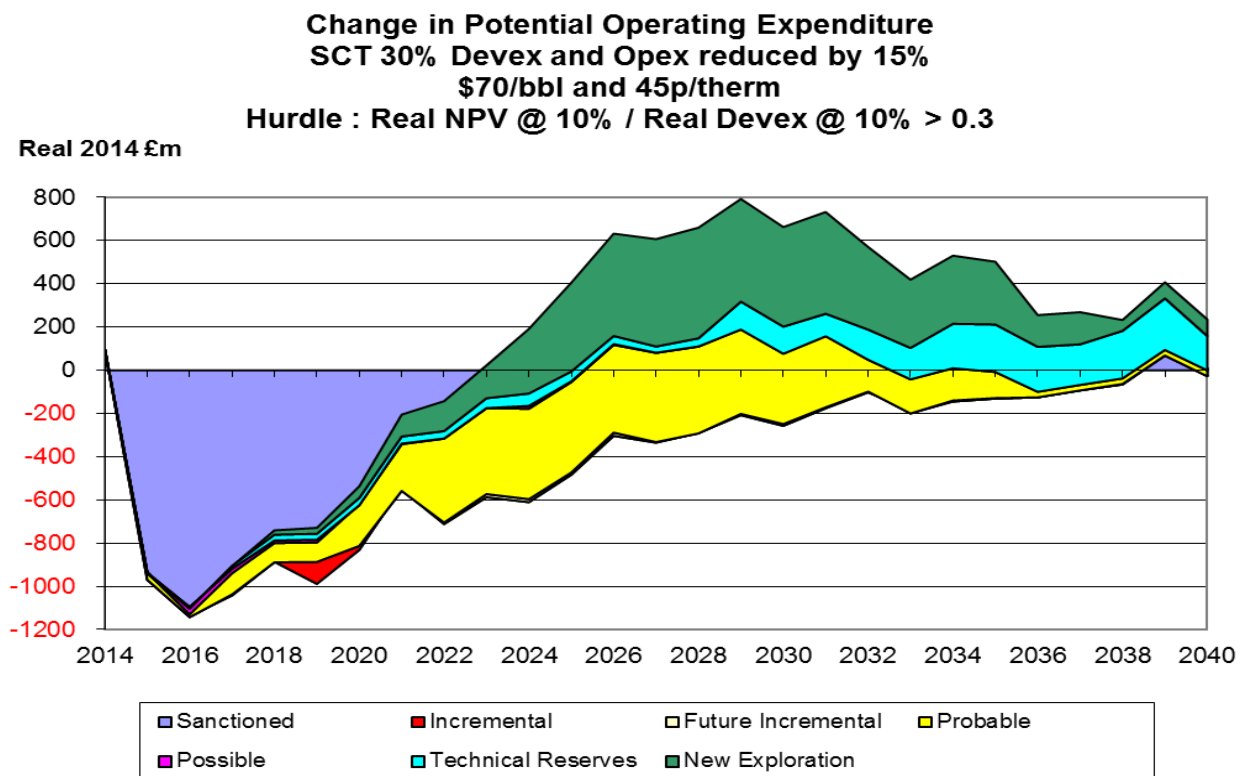
Chart 9

Change in Potential Development Expenditure
SCT 30% Devex and Opex reduced by 15%
\$70/bbl and 45p/therm
Hurdle : Real NPV @ 10% / Real Devex @ 10% > 0.3



The changes to development expenditure are shown in Chart 9. Two effects of the cost savings are identified separately. For new projects and fields which are viable before the cost reductions there is a negative effect on the investment expenditures from the cost savings. The value of this is shown in Chart 9 in the negative areas. These are quite significant in the near term as they apply to expenditures on currently sanctioned fields as well as those not yet sanctioned. The positive investment expenditures refer to those relating to new fields and projects whose viability has been triggered by the cost savings. It is noteworthy that over the period to 2050 the net cumulative increase in investment is £20 bn.

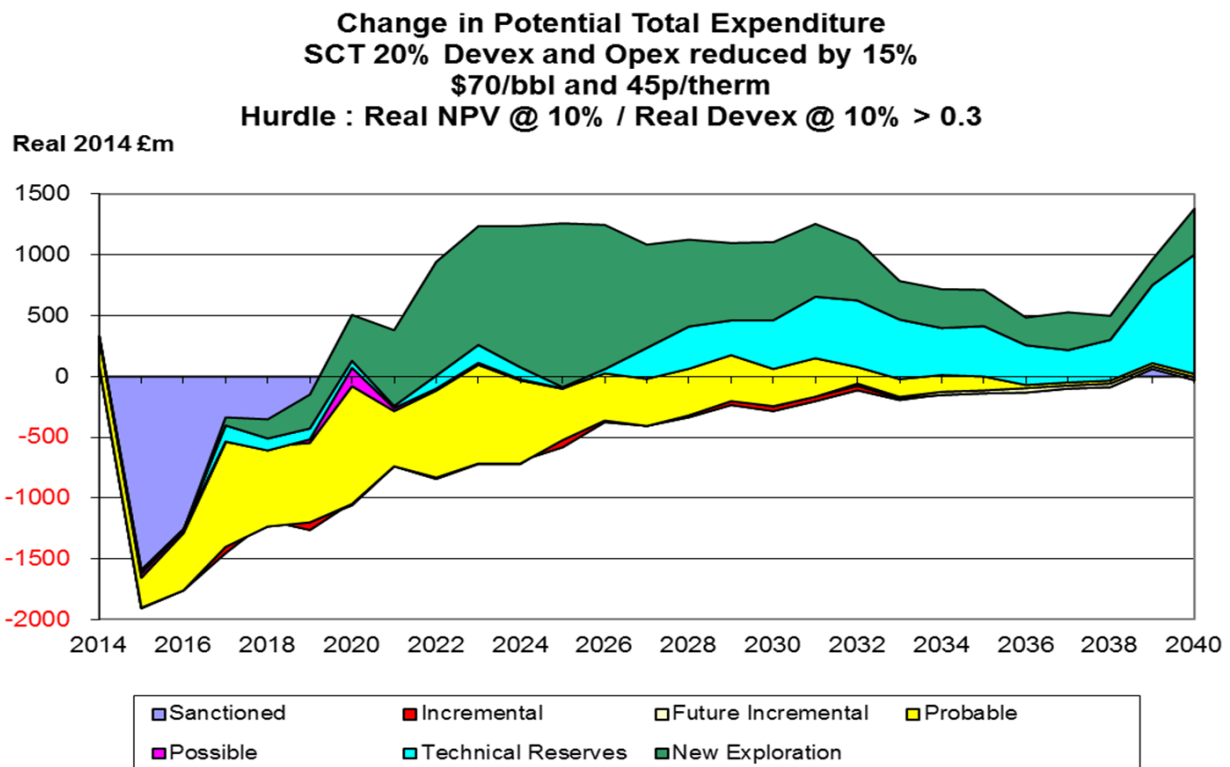
Chart 10



In Chart 10 the changes in operating expenditures are shown. For some years from 2015 there is a large negative effect on

expenditures from the cost savings on existing sanctioned fields. There is also a negative effect from the reductions of expenditure on new fields and projects which go ahead before the cost savings. There is also a growing positive effect on operating expenditures from the costs incurred on the new fields and projects whose development is triggered by the cost savings. Over the period to 2050 there is a cumulative net increase in operating expenditures of £17.7 bn. Decommissioning expenditures increase by £2.2 bn over the period. The result for total field expenditures is shown in Chart 11.

Chart 11



(d) SC reduced to 20%

The effects of a reduction in the SC rate to 20% with no other changes from the base case are now examined. In Chart 12 the

changes to total hydrocarbon production are shown. The cumulative increase in the period to 2050 is 441 mm boe. Total recovery in the period to 2050 is 12.34 bn boe. The increase is seen to come primarily in the period after 2020.

Chart 12

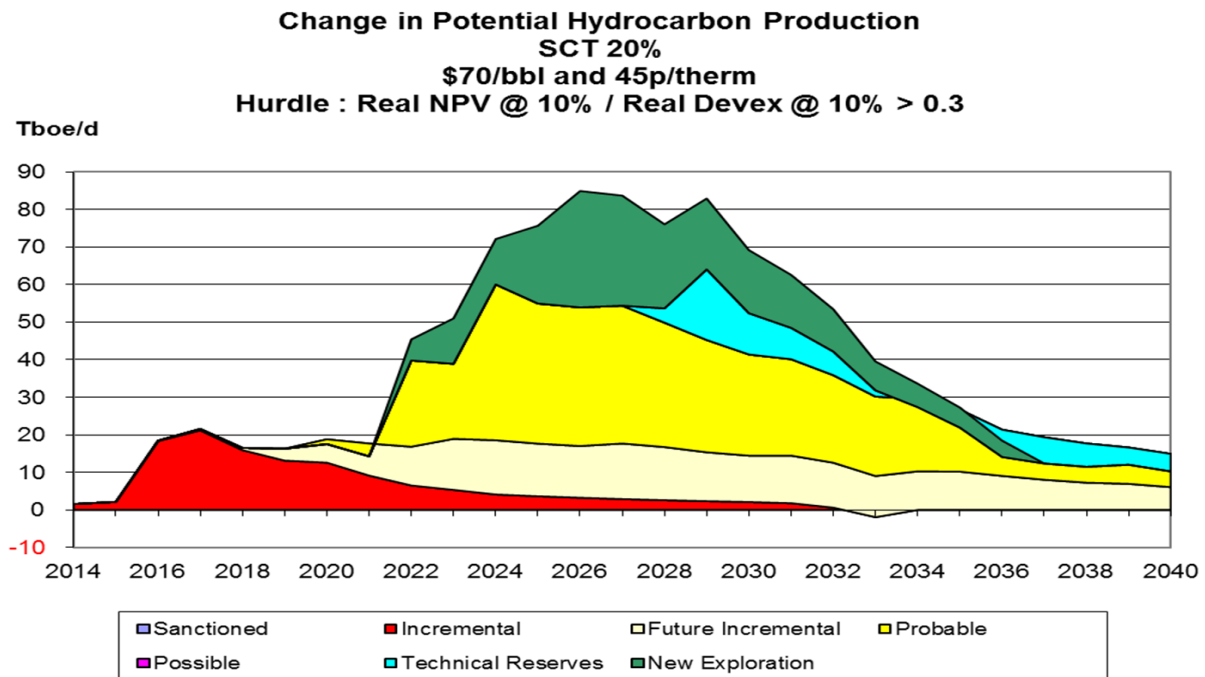
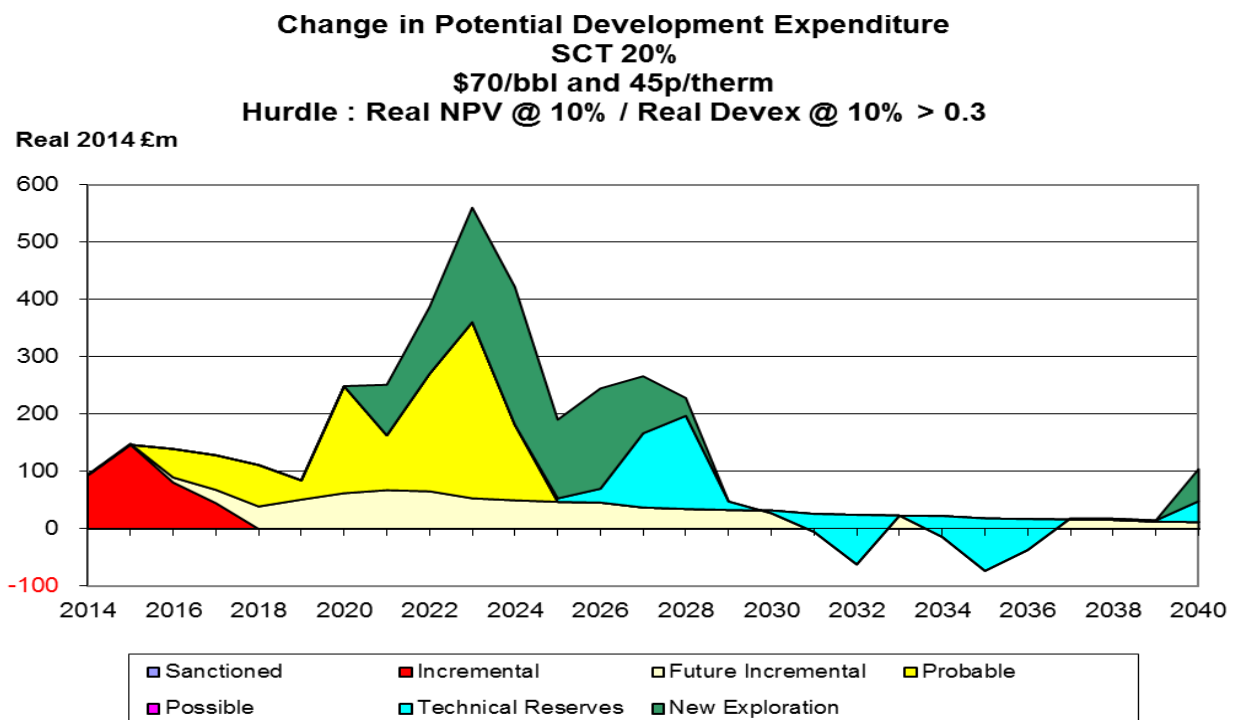


Chart 13



In Chart 13 the changes to development expenditures are shown. The cumulative increase in the period to 2050 is £4.1 bn. Much of this comes in the period 2020-2030. In Chart 14 the changes to operating expenditures are shown. The cumulative increase in the period to 2050 is £5.4 bn. Much of this comes within the time period 2020-2036. In Chart 15 the changes to total field expenditures (including decommissioning) are shown. There is a noteworthy increase in the years from 2020.

Chart 14

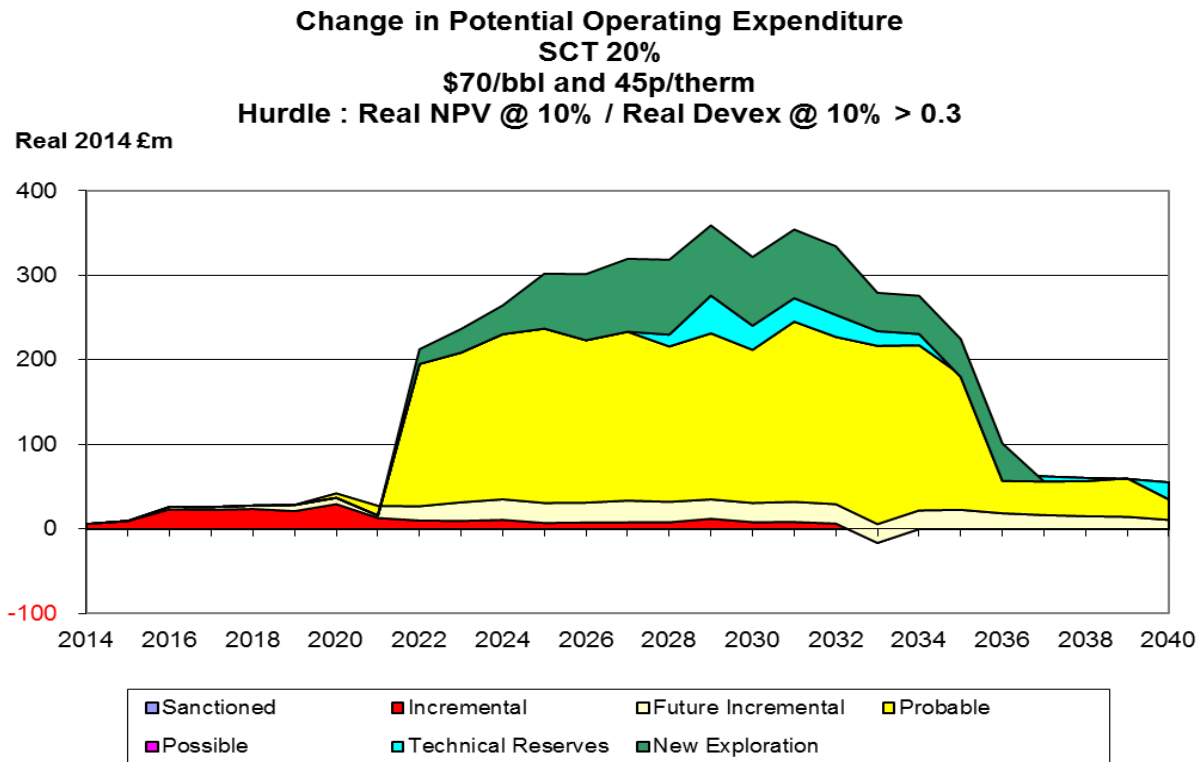
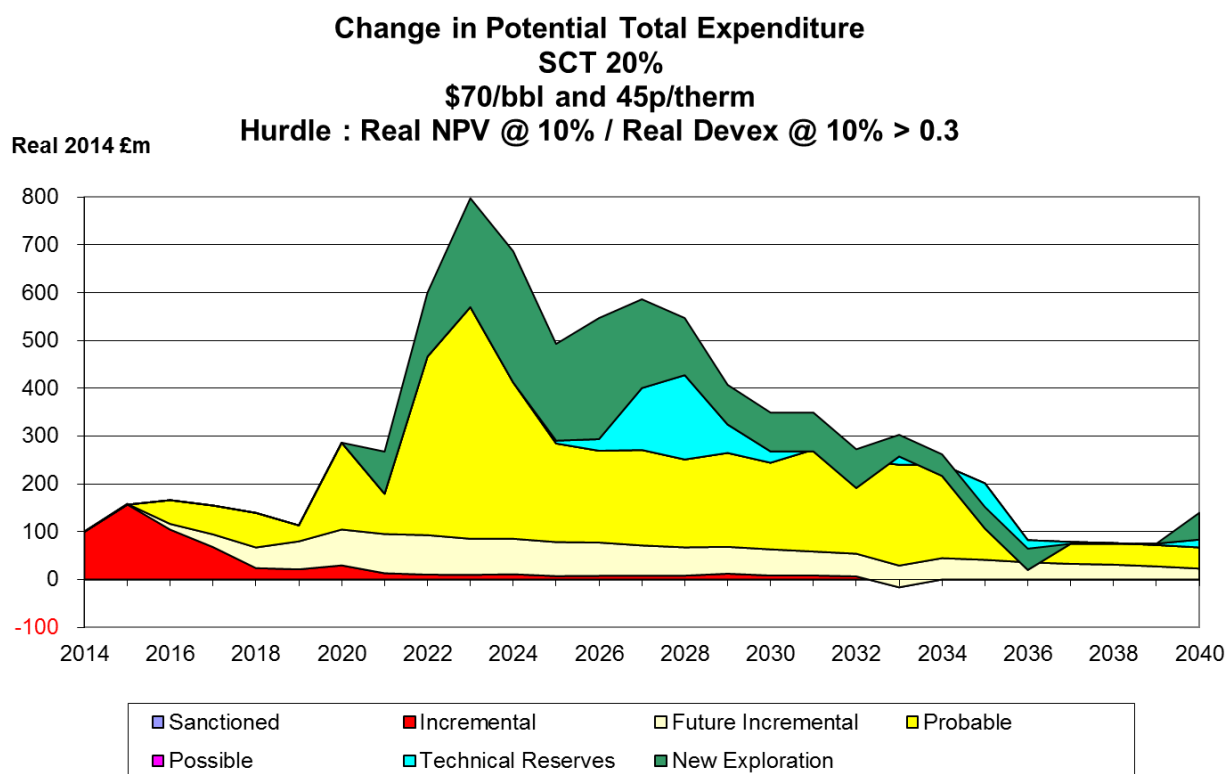


Chart 15



It is clear from the above that the reduction in the SC rate on its own does not produce a major change to new investment. But it should be recognised that the case for the reduction is also based on the negative cash flow position currently being experienced by the industry.

(e) Cost Savings of 15% plus SC rate of 20%

The results of cost savings of 15% plus a reduction in the SC rate to 20% are now examined. In Chart 16 the changes in total hydrocarbon production are shown. Over the period to 2050 the cumulative increase is 2.5 bn boe. The total recovery to 2050 becomes 14.4 bn boe. The positive effects start early and become increasingly substantial to 2026 where the extra output peaks at 400,000 boe/d.

Chart 16

Change in Potential Hydrocarbon Production
SCT 20% Devex and Opex reduced by 15%
\$70/bbl and 45p/therm
Hurdle : Real NPV @ 10% / Real Devex @ 10% > 0.3

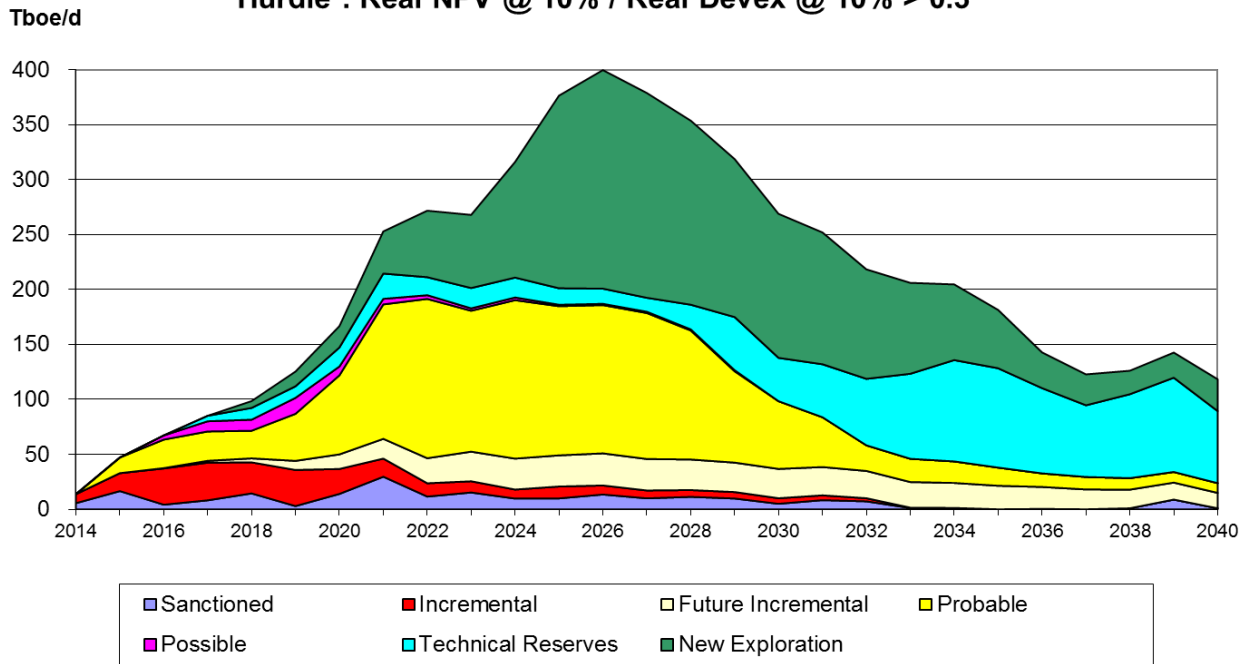
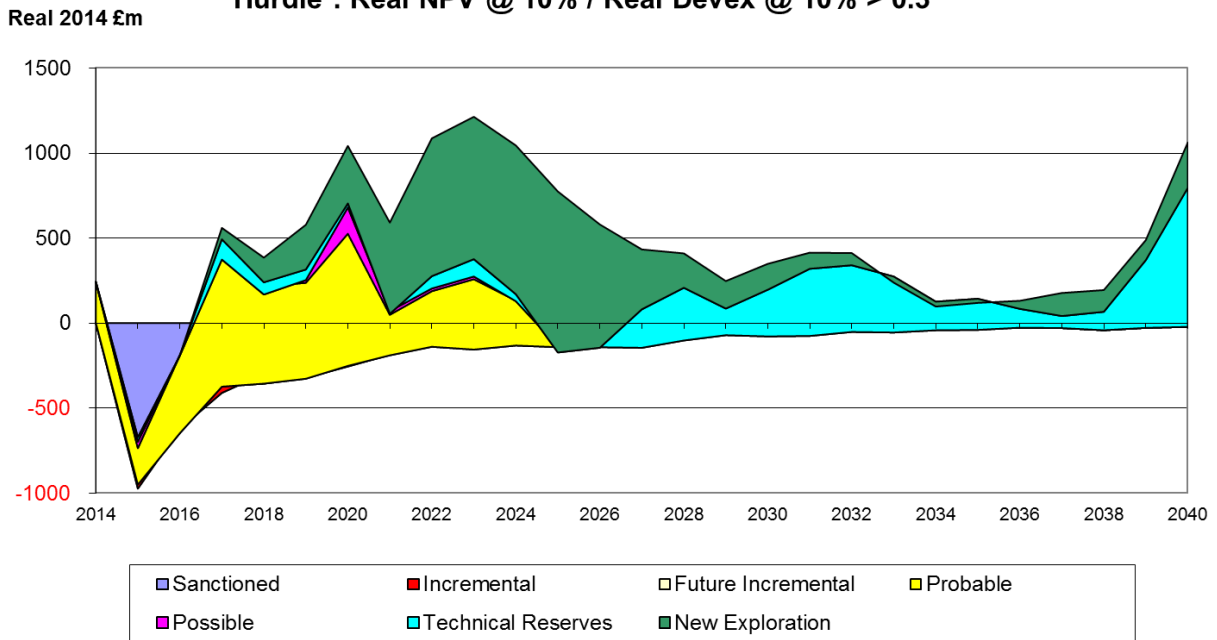


Chart 17

Change in Potential Development Expenditure
SCT 20% Devex and Opex reduced by 15%
\$70/bbl and 45p/therm
Hurdle : Real NPV @ 10% / Real Devex @ 10% > 0.3



In Chart 17 the changes to development expenditures are shown. There are negative effects in the early years reflecting the reductions on fields currently sanctioned. But these are soon outweighed by substantial expenditures on new fields and projects whose viability has been triggered by the cost savings. Over the period to 2050 the net increase in development expenditures is £20.8 bn.

Chart 18

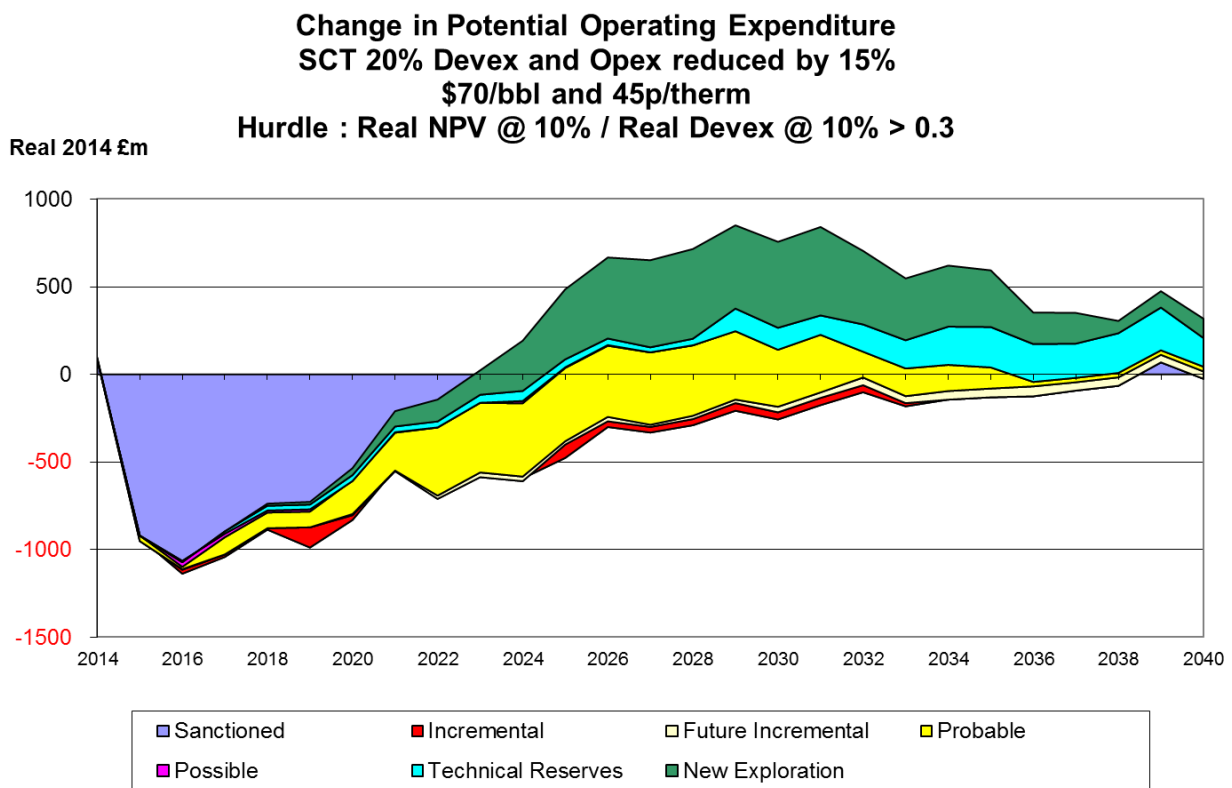
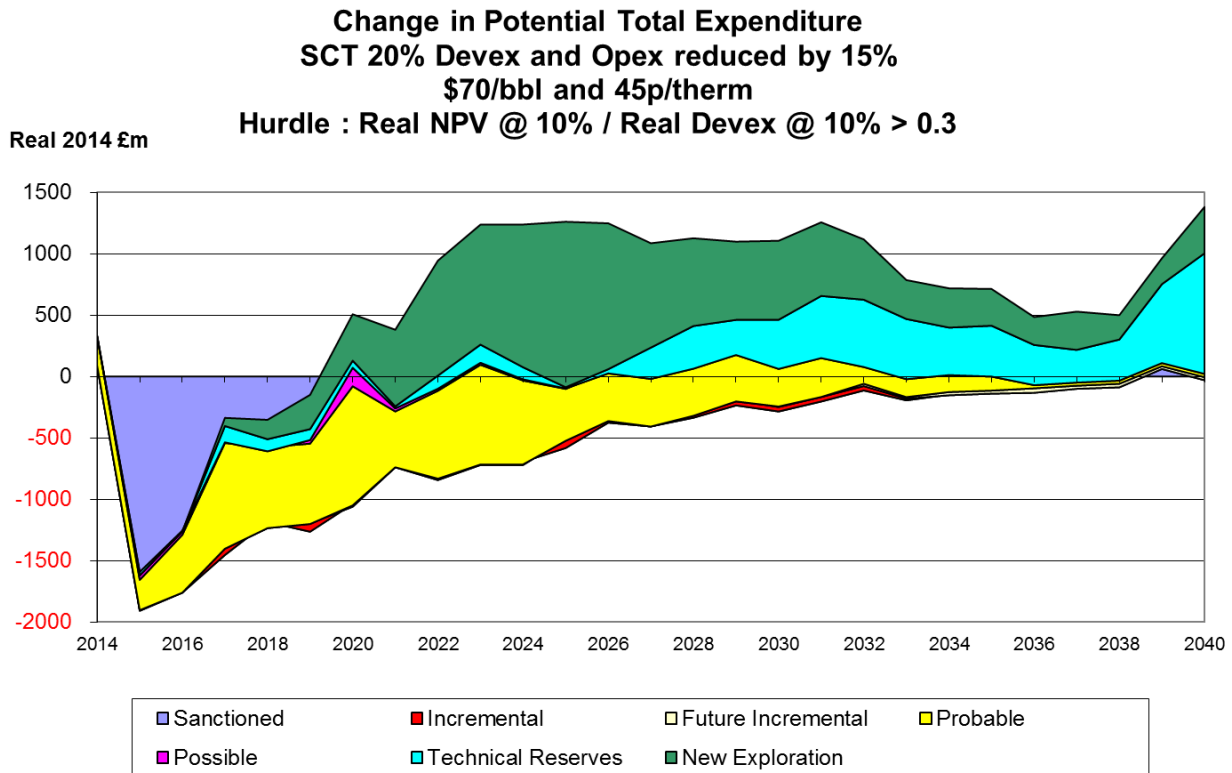


Chart 19

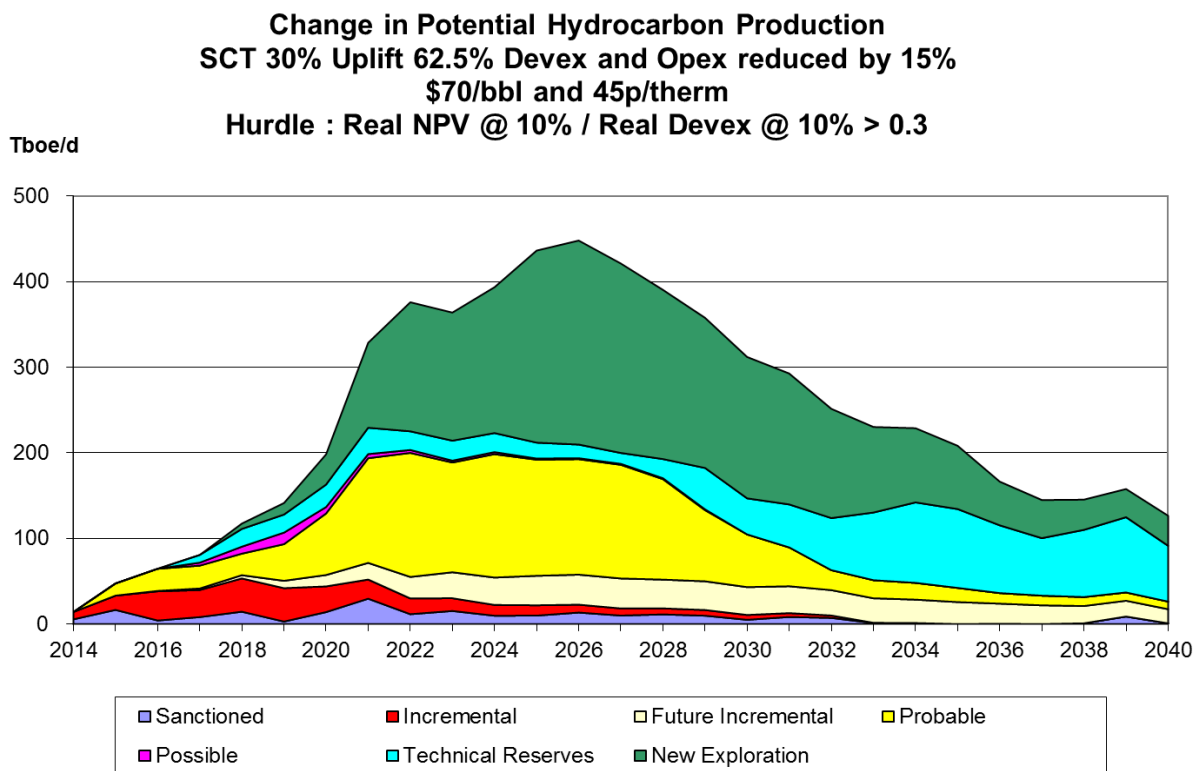


The changes to operating expenditures are shown in Chart 18. There are major reductions over the next few years reflecting the cost reductions on existing producing fields as well as on new ones whose development takes place without the cost savings. But, over time the positive effects of operating expenditures on fields triggered by the cost savings become greater. Over the period to 2050 there is a net increase in operating expenditures of £19.9 bn. Over the period there is also a net increase in decommissioning expenditures of £2.3 bn. The changes to total field expenditures are shown in Chart 19.

(f) Investment Allowance of 62.5% for SC plus Cost Savings of 15%

The effects of the Investment Allowance at 62.5% plus cost savings of 15% across the board are now examined. In Chart 20 the changes to total hydrocarbon production are shown. There is a substantial increase reaching a peak of over 620,000 boe/d in 2026. Over the period to 2050 the cumulative increase is 2.4 bn boe. Total recovery in the period to 2050 becomes 14.3 bn boe.

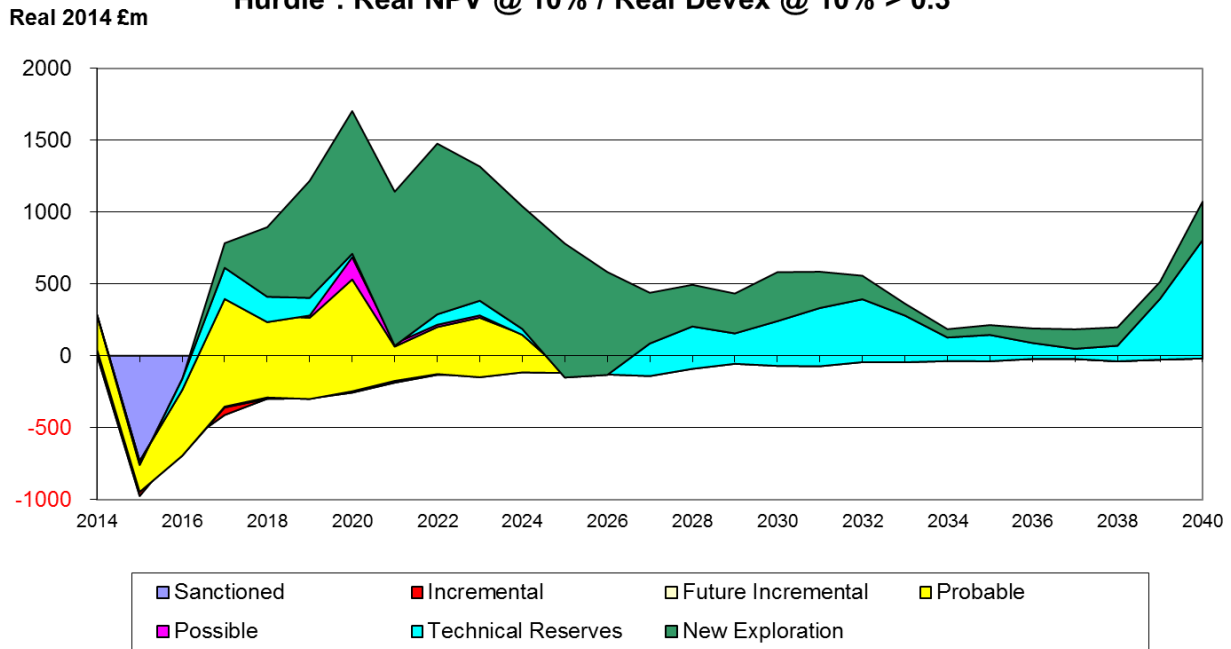
Chart 20



In Chart 21 the changes to development expenditures are shown. There is a negative effect in the early years from the reduction in expenditures on sanctioned fields. But this is quite quickly dwarfed by the increased expenditure on field developments triggered by the cost savings and tax rate reduction. Over the period to 2050 the cumulative net increase in field investment is £19.6 bn.

Chart 21

Change in Potential Development Expenditure
SCT 30% Uplift 62.5% Devex and Opex reduced by 15%
\$70/bbl and 45p/therm
Hurdle : Real NPV @ 10% / Real Devex @ 10% > 0.3



The changes to operating costs are shown in Chart 22. There is a large negative effect from the reduced expenditures on currently sanctioned fields as well as on new projects which proceed without the cost savings. But the positive effect from expenditures on new fields and projects triggered by the cost savings becomes increasingly important, and over the period to 2050, the net increase is £25.4 bn. There is an increase in decommissioning expenditures of £2.2 bn over the period. The total changes to field expenditures are shown in Chart 23.

Chart 22

Change in Potential Operating Expenditure
SCT 30% Uplift 62.5% Devex and Opex reduced by 15%
\$70/bbl and 45p/therm
Hurdle : Real NPV @ 10% / Real Devex @ 10% > 0.3

Real 2014 £m

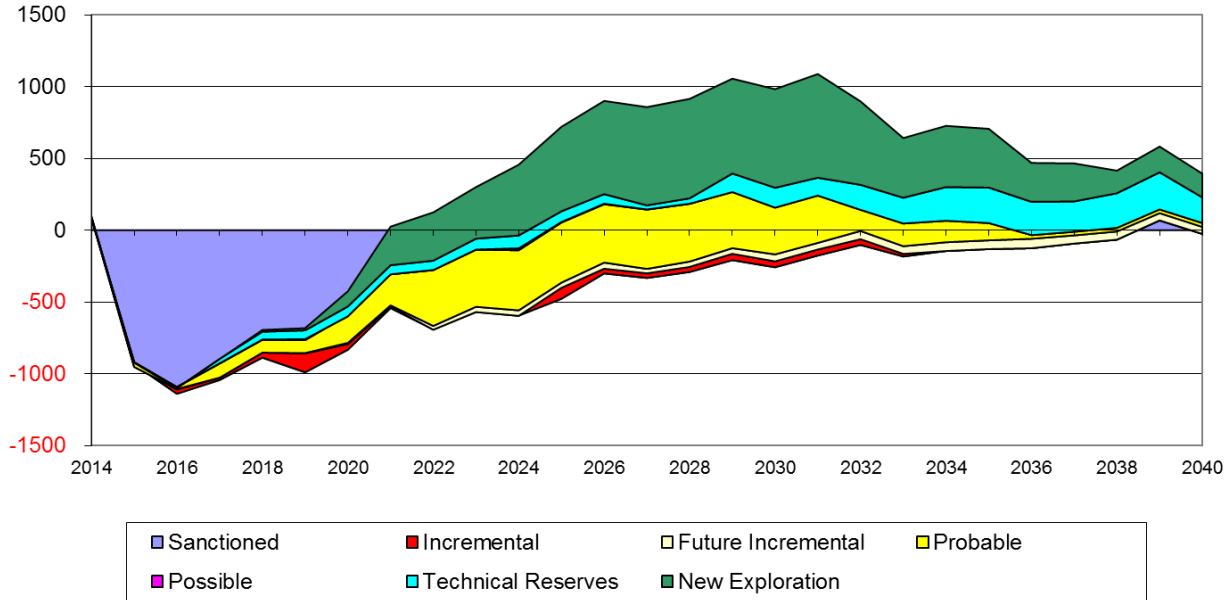
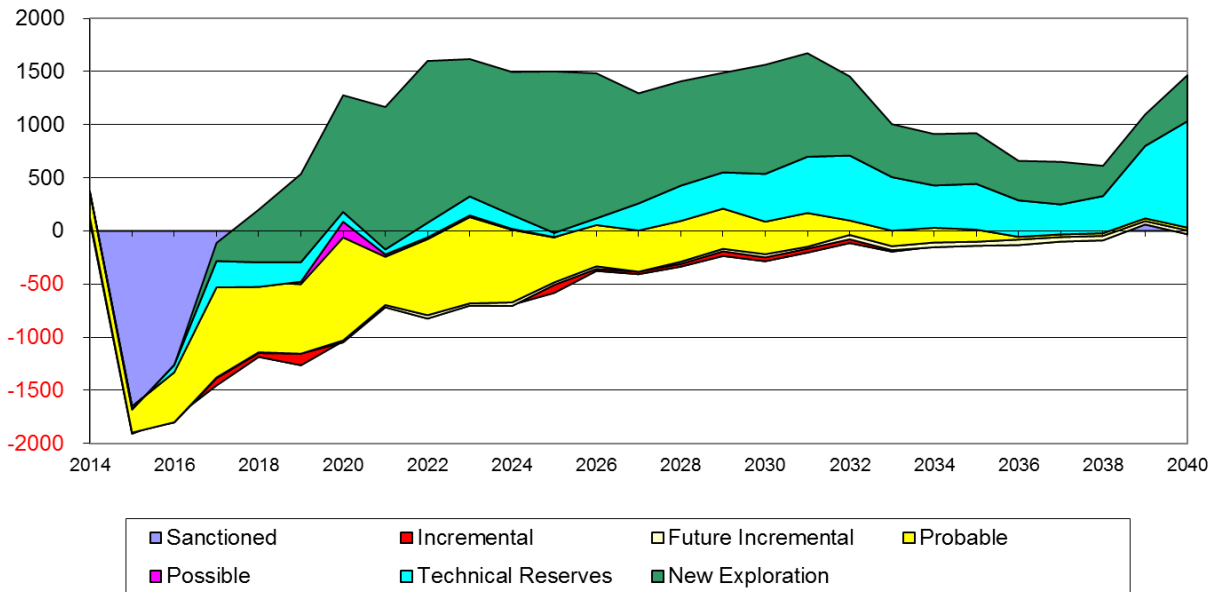


Chart 23

Change in Potential Total Expenditure
SCT 30% Uplift 62.5% Devex and Opex reduced by 15%
\$70/bbl and 45p/therm
Hurdle : Real NPV @ 10% / Real Devex @ 10% > 0.3

Real 2014 £m



(g) Investment Allowance of 62.5% for SC plus Cost Savings of 15% plus SC at 20%

The effects of a combination of cost savings of 15%, plus Investment Allowance of 62.5% for SC, plus a rate of 20% for SC are now examined. In Chart 24 the changes to total hydrocarbon production are shown. There is a very substantial increase which reaches a peak of 450,000 boe/d in 2026. Over the period to 2050 the cumulative increase is 2.8 bn boe from the cost savings and tax reductions. Total recovery to 2050 becomes 14.7 bn boe.

Chart 24

Change in Potential Hydrocarbon Production
SCT 20% Uplift 62.5% Devex and Opex reduced by 15%
\$70/bbl and 45p/therm
Hurdle : Real NPV @ 10% / Real Devex @ 10% > 0.3

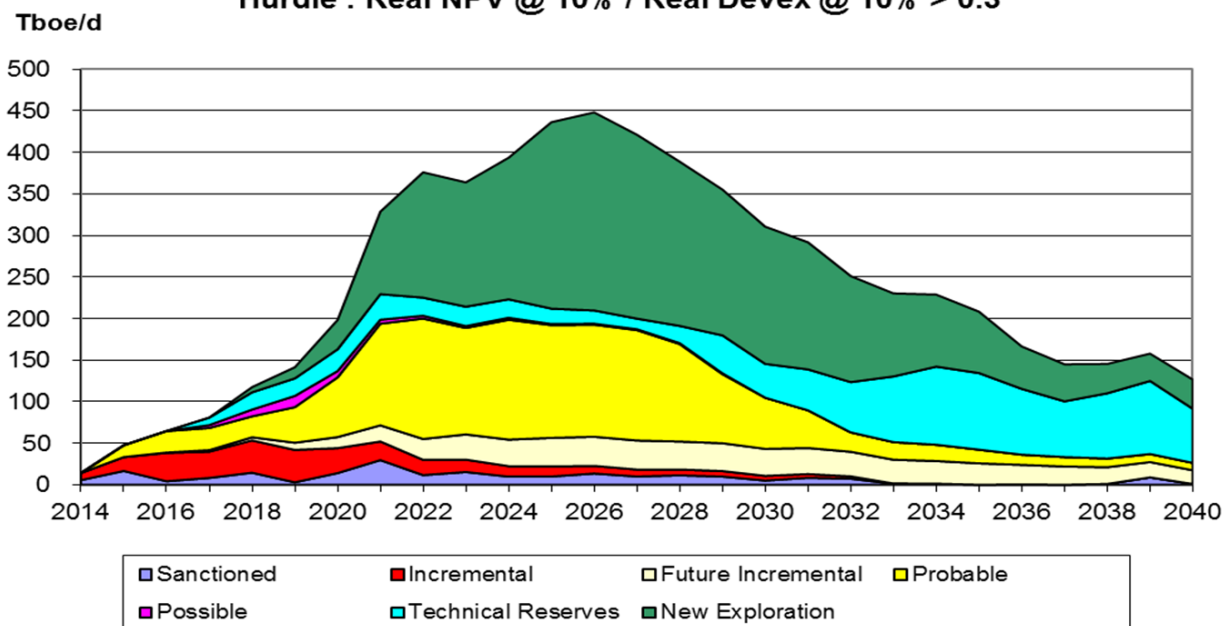


Chart 25

Change in Potential Development Expenditure
SCT 20% Uplift 62.5% Devex and Opex reduced by 15%
\$70/bbl and 45p/therm
Hurdle : Real NPV @ 10% / Real Devex @ 10% > 0.3

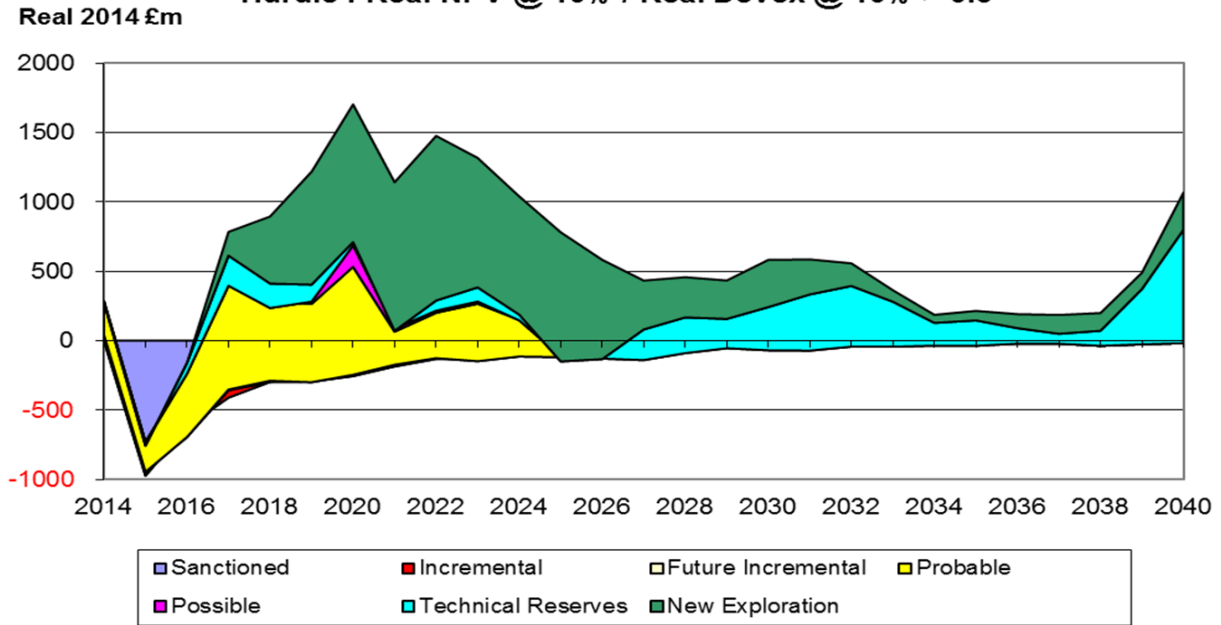
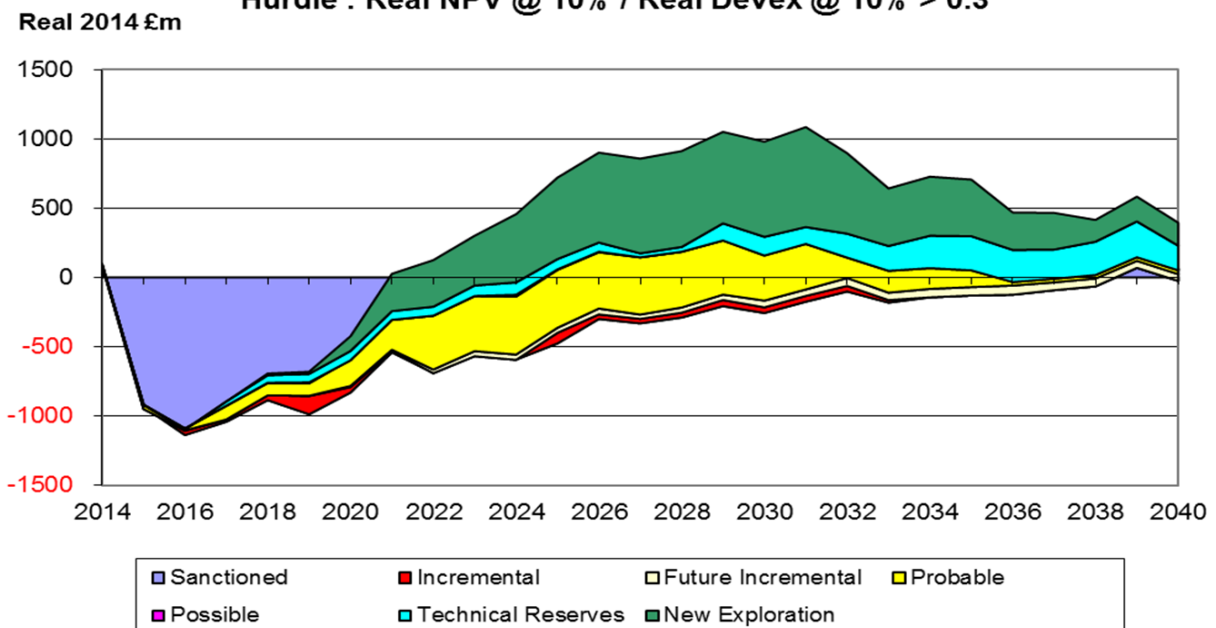


Chart 26

Change in Potential Operating Expenditure
SCT 20% Uplift 62.5% Devex and Opex reduced by 15%
\$70/bbl and 45p/therm
Hurdle : Real NPV @ 10% / Real Devex @ 10% > 0.3

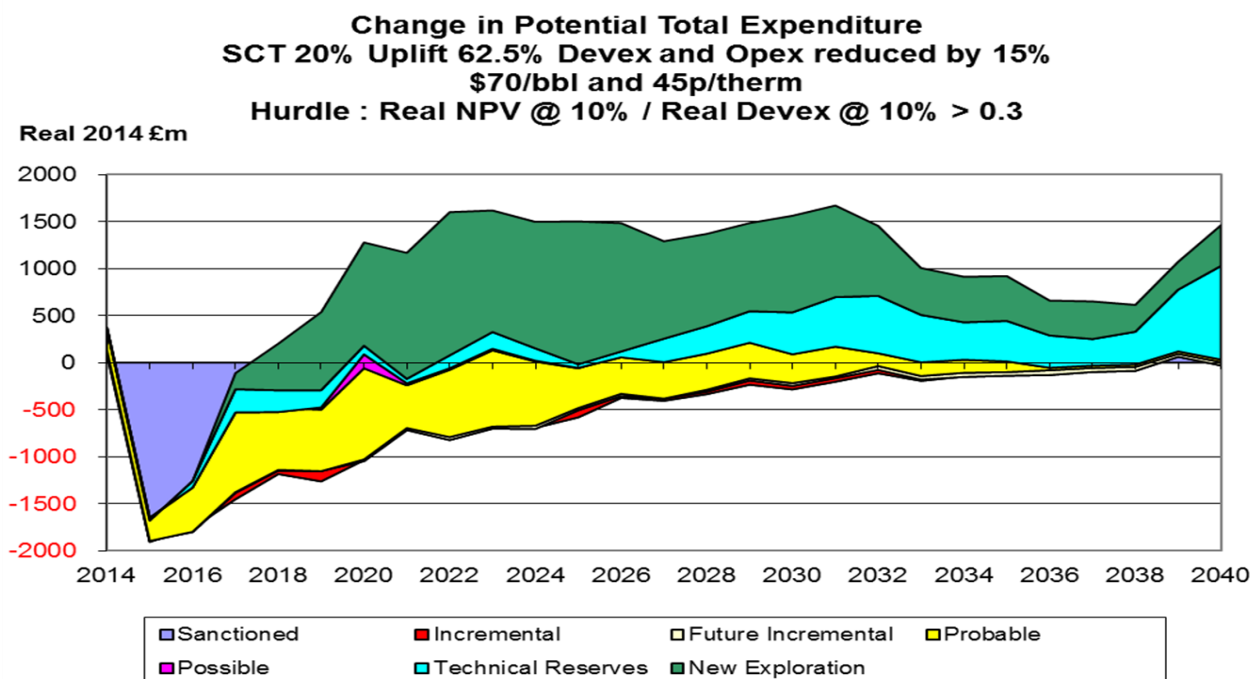


In Chart 25 the changes to development expenditures are shown. The positive effects from investment in new fields and projects are seen to greatly outweigh the negative effects from cost savings on fields and projects which go ahead without the cost reductions. The net increase over the period to 2050 is £22 bn from the cost savings and tax reductions.

In Chart 26 the changes to operating expenditures are shown. There are large negative effects from the cost savings on sanctioned fields in particular. But over the whole period these are exceeded by expenditures on new fields and projects whose development is triggered by the cost savings and tax reductions. The net increase in the period to 2050 is £23.4 billion.

Over the period to 2050 the increase in decommissioning expenditures is £2.8 bn. The changes to total field expenditures are shown in Chart 27.

Chart 27



4. Summary and Conclusions

This paper is responding to the HMT Consultation on an Investment Allowance for Supplementary Charge (SC) in the UKCS. In examining the effectiveness of the allowance in enhancing economic recovery it was felt desirable to make the assessment in the context of other changes to the investment environment in the UKCS, particularly cost reductions and another tax change which has been frequently mooted, namely a reduction in the rate of SC. Several other tax changes are desirable (such as to PRT) and these will be the subject of further research. The emphasis of the research is on the extent to which the various measures, either singly or in combination, can enhance economic recovery. The economic modelling was undertaken at a price scenario of \$70 per barrel and 45 pence per therm in constant real terms. In MOD terms the oil price reaches \$170 per barrel in 2050 the end point of the modelling.

Under the present tax system, and before any cost reduction, it was found that cumulative production from the present to 2050 could be 11.9 bn boe. Total cumulative field development costs would be £81.4 bn at 2014 prices, total operating expenditures £135 bn, and total decommissioning costs £41.8 bn.

If the investment allowance at the rate of 62.5% replaced the existing plethora of field allowances for SC on fields not yet sanctioned there would be an increase in total hydrocarbon production to 2050 of 703 mm boe. Total cumulative production to 2050 then becomes 12.6 bn boe. Field investment would increase by a total of £10 bn and field operating costs by £7.1 bn.

It is noteworthy that this increased activity, while significant, is much less than that achieved by the same investment allowance when the screening prices are \$90 and 58 pence in real terms. In this scenario the total increase in production to 2050 is 1.57 bn boe and the increase in field development expenditure £26.8 bn. The explanation is that, at the lower oil price, many new projects/fields remain non-viable, often on a pre-tax basis.

Accordingly, the effects of a 15% cost reduction across the board with no changes to the tax system were examined. The result was a major increase in cumulative production to 2050 of 2.27 bn boe. This means that the total recovery to 2050 becomes 14.17 bn boe. Field development expenditures have negative and positive consequences. The cost savings result in reduced expenditures on fields and projects which would in any case proceed at the \$70, 45 pence price scenario. The positive effect is the increased expenditure on the development of fields and projects which were non-viable before the cost savings. The net result in the present case is a cumulative increase in development expenditure of £20 bn in the period to 2050.

With respect to operating costs the negative effect on operating expenditures is very large in the next few years because the savings apply to all the currently sanctioned fields. Over the whole period to 2050, however, there is a large net increase in operating expenditures of £17.7 bn.

The next change considered was a reduction in the rate of SC to 20% with no other changes. The result was an increase in total hydrocarbon production to 2050 of 441 mm boe, resulting in a total recovery of 12.34

bn boe. Cumulative field investment increases by £4.1 bn over the period and total operating expenditures increase by £5.4 bn.

The next changes considered were a combination of cost savings of 15% plus a reduction in the SC rate to 20%. In this case the increase in total production to 2050 is 2.5 bn boe. The resulting total recovery to 2050 is 14.4 bn boe. Cumulative field investment increases by £20.8 bn, and cumulative operating expenditures increase by £19.9 bn.

The next changes considered were a combination of cost savings of 15% plus investment allowance for SC of 62.5%. The result is an increase in total production of 2.4 bn boe resulting in a total recovery of 14.3 bn boe over the period. Field investment expenditure exhibits a net increase of £19.6 bn to 2050 and operating expenditures a net increase of £25.4 bn.

The last changes examined were a combination of cost savings of 15%, investment allowance for SC of 62.5%, and rate of SC at 20%. The result is an increase in cumulative production of 2.8 bn boe, producing a total recovery 14.7 bn boe over the period to 2050. Total field investment increases by £22 bn over the period and operating expenditures increase by £23.4 bn.

The study has the merit of showing the comparative effects of different changes to the investment environment in the UKCS. It is arguable that a combination of the changes discussed has merit. In short they reinforce each other. Thus the cost reductions increase taxable incomes while the tax reductions increase the returns to cost savings implemented by licensees. The investment allowance, while valuable, cannot by itself

transform the economic environment in the UKCS and needs to be reinforced by other measures.