

## DRAFT EAG PAPER ON EXPLORATION

1. On behalf of PILOT, ILT has commissioned a study from EAG to reconcile [or "reality check"] (Yet-to-Find) reserves - as represented by the "Unified Reserves Model" - and planned (exploration) activity levels; to identify incompatibilities between them; and to assess blockers and enablers to any incompatibilities. This note is intended to be a contribution to the debate on these issues, focusing on how existing estimates of Yet-to-Find (YTF) reserves fit with current or potential activity levels. A number of suggestions are made for additional analyses that would be helpful.

2. The starting point for this discussion is the UKOOA paper "The Window of Opportunity for the UKCS" (February 2005) which describes the reserves "model" developed in 2004 as part of the PILOT "Brownfields Studies" by, and with data from, UKOOA, Wood Mackenzie and DTI. Table 2 in that paper was as follows:

Recovered Reserves (bn boe)	Screened Reserves Total	Current Activity (% of screened reserves)		High Activity (% of screened reserves)		
		Pre-2015	Pre-2035	Pre-2015	Pre-2035	
Onstream, Under Dev. and Probable	11.0	10.1 (92%)	11.0 (100%)	10.1 (92%)	11.0 (100%)	
Possibles	1.0	0.7 (71%)	1.0 (100%)	0.7 (71%)	1.0 (100%)	
Potential Additional Reserves (PARs)	2.0	0.6 (30%)	2.0 (100%)	0.7 (36%)	2.0 (100%)	
Yet-to-Find Reserves	North Sea	5.7	0.4 (8%)	3.5 (60%)	0.6 (11%)	4.4 (76%)
	W of Shetl.	1.6	0.2 (11%)	1.6 (100%)	-	-
Brownfield Incremental	4.0	0.5 (12%)	0.7 (18%)	0.7 (18%)	1.1 (29%)	

3. This shows cumulative production ("Recovered Reserves") to 2015 and to 2035 for "current" and "high activity" cases together with the percentage of the screened reserves produced by those dates. It should be noted that the reserves *discovered* by 2015 would be far greater than the reserves *produced* by that date (which amount to only 8% of the North Sea's screened YTF Reserves). **It would be helpful if UKOOA could document the time profile of reserves discovery (as distinct from production) implicit in the modelling, perhaps at 5 yearly intervals.**

4. In the case of YTF Reserves, as described in the paper, UKOOA adopted a screening process which excluded from the model YTF Reserves West of Scotland, in other areas of the UKCS where detailed studies are limited or have not been

carried out and onshore. In these areas, according to UKOOA, DTI estimated (on central assumptions) recoverable undiscovered resources to total 1.5 billion boe as at the end of 2003 (1.2 billion West of Scotland, 0.3 billion on land and in "other" UKCS areas). A further screening process (described in Appendix C to the UKOOA paper which is reproduced below) reduced the YTF Reserves in the North and Irish Seas from 5.8 to 5.7 billion boe but left unchanged (at 1.6 billion boe) the YTF Reserve West of Shetland. It should be noted that the DTI central estimate is just that, a central estimate. DTI also publishes low ("P90") and high ("P10") estimates of undiscovered recoverable resources which are, respectively, roughly half and more than double the size of the central estimate for the UKCS as a whole (with, unsurprisingly, wider ranges in the less well explored areas such as the West of Shetland/Scotland).

### **PROCESS FOR SCREENING YET-TO-FIND (YTF) RESOURCES**

The DTI prospect database has been screened as below to remove the prospects which are unlikely to be drilled. Given that only the risked volumes and distance to infrastructure are available, significant assumptions have been required.

- All prospects with a chance of success less than 1 in 20 have been removed
- Prospects that are unlikely to be developed because they are too small and distant from infrastructure or too risky have been removed.

#### a) Assumptions for the North Sea and Irish Sea

- Removed all prospects which are risked at below 4 mmboe and over 10 kilometres from existing infrastructure
- Removed all prospects which are risked at below 8 mmboe and over 20 kilometres from existing infrastructure

#### b) Assumptions for the WoS prospects

- All prospects less than 16 mmboe have been removed
- All prospects greater than 10 kilometres from infrastructure and less than 32 mmboe have been removed
- All prospects greater than 20 kilometres from infrastructure and less than 64 mmboe have been removed

#### c) Assumptions for Heavy Oil

- Removed all prospects which are risked at below 32 mmboe

This screening was done by DTI since UKOOA were only provided with aggregated data.

5. The assumptions underlying the two scenarios were set out in Table 1 of the paper as follows:

<b>Assumptions under the Current and High Activity Cases</b>		
	<b>Current Activity</b>	<b>High Activity</b>
Oil Price (real 2004)	US\$ 20.5/bbl from 2008 onwards, falling from current levels out to 2008	US\$ 30/bbl from 2008 onwards, falling from current levels out to 2008
Onstream, Under Development and Probable Development	Wood Mackenzie's published profiles	All reserve upside is captured in the categories below
Possibles	Additional UKOOA Probables / Possibles from 2003 Activity Survey	No further reserves meet the economic criteria at an oil price of \$30
Brownfield Incremental	Assumes an annual growth in commercial reserves of 1.6% for oil and 0.9% for gas	The annual rate of increase in commercial reserves is doubled to 3.2% for oil and 1.9% for gas
Potential Additional Reserves (PARs)	An average of 10 fields per year receive approval (between 2008 and 2020)	An average of 14 fields per year receive approval (between 2008 and 2020)
Yet-to-find (YTF)	Declining E&A drilling rate from average (over the last 4 years)	Increase in E&A drilling rate by 25% in 2005 and flat to 2010 before declining
All categories	A total of 16 fields per year receive approval (5-year average)	A total of 22 fields receive approval

6. The UKOOA paper does not specify in detail the assumptions made regarding the absolute level and distribution between parts of the UKCS of the E&A drilling activity underlying the two scenarios so it is difficult to comment on the reasonableness of these assumptions. **It would be helpful if UKOOA could document the number of exploration wells they have assumed each year and where these are assumed to be (e.g. West of Shetland, Irish Sea, Southern Basin, Central North Sea or Northern North Sea).** It is worth noting that the recent joint DTI/UKOOA Exploration and Appraisal Activity Survey found operators intending to drill around 45 exploration wells in the Central and Northern North Sea in 2005 with a further dozen or so exploration wells elsewhere, especially in the Southern Basin. It remains to be seen whether all of these wells will be drilled because of the tight state of the rig market. For example, 3i have recently noted (in "The prospects for North Sea oil and gas: challenges and opportunity in a maturing province", April 2005) that "the now exceptionally positive outlook has driven demand for mobile drilling units to the point where the North Sea now faces an acute shortage of working rigs".

7. Intentions for 2006 and 2007 are significantly lower but, at around 30 wells in 2006 and around 25 in 2007, still close to the actual numbers of exploration wells drilled in both 2003 and 2004. Unless conditions change dramatically, actual exploration drilling activity in 2006–2007 seems likely to be higher than in 2003–2004

as operators' plans get firmed up and drilling budgets get set. It should be noted here that there are differences between the way wells are categorised by DTI and, for example, Wood Mackenzie and whether sidetracks are included or excluded, making precise comparisons difficult.

8. It should be possible to use recent experience on exploration success to gauge the plausibility of the reserve discovery implied by the UKOOA model. Late last year, Wood Mackenzie produced a Multi-Client Study "Global Oil and Gas Risks and Rewards 2004" which summarises 10 years' worth of data on exploration and appraisal activity worldwide. The following table draws on data from this study on the UKCS (by combining data for the Southern Basin and "Shelf"). In order to facilitate comparisons with the UKOOA model, **it would be helpful if Wood Mackenzie were able to provide a similar analysis for the UKCS excluding the West of Shetland/Scotland.**

Total/Average	Exploration		Commercial Discoveries	Commercial Success	Average Commercial Discovery	Technical Discoveries	Technical Success	Average Technical Discovery
	Wells	Dry Holes	Total	Rate Total	(mmboe)	Total	Rate Total	(mmboe)
1994-98	262	185	35	13%	30.8	42	16%	14.5
1999-03	114	73	17	15%	51.5	24	21%	14.6
1994-2003	376	258	52	14%	37.6	66	18%	14.5

Source: Wood Mackenzie Multi-Client Study "Global Oil and Gas Risks and Rewards 2004"

9. From this table one might conclude that, using the past as a guide to the future, roughly 15% of exploration wells will make a commercial discovery with, on average, commercial reserves of 30–50 million barrels of oil equivalent in each such discovery. (The large Buzzard discovery is evident in the figures for 1999–2003. It is difficult to know whether its effect should be discounted or not since we do not yet know if it was a one-off.) A further 15–20% of exploration wells will make a technical discovery with, on average, technical reserves of 15 million barrels of oil equivalent. With the passage of time and improvements in technology, together with periods of higher prices, a significant proportion of these technical reserves may be developed. So the average exploration well on the UKCS might have a chance of discovering a commercial or potentially commercial field with reserves of between 50 million boe and 20 billion boe with a probability of between 15 and 35%. That means an average reserve discovered per well of around 7 million boe. With 25 exploration wells a year, it would take between 5 and 6 years to discover 1 billion boe of commercial reserves. Similarly, 3.5 billion boe would be discovered in 20 years, though it is unlikely that that pace of exploration activity would continue for so long, especially if by then much of the existing infrastructure in the North Sea had been decommissioned.

10. It is worth noting that, during the consultation on low levels of exploration activity in the North Sea in 2003,<sup>1</sup> an attempt was made to compare DTI and industry estimates of the YTF potential of the UKCS. For the "rest of the UKCS" (i.e. excluding West of Shetland/Scotland), on a broadly comparable basis both DTI and

1. See <http://www.og.dti.gov.uk/consultations/conllexp.htm>.

industry estimated technically risked YTF reserves at close to 6 billion boe with an average 60% of these reserves passing industry's commercial risk thresholds. Against that background, the UKOOA YTF numbers - and in particular the projected production of 3.5 billion boe from screened YTF reserves of 5.7 billion boe by 2035 - seem to be reasonable.

11. In terms of blockers and enablers, it is worth considering the issues identified in response to the exploration consultation of 2003. There is little that can be done about global materiality or high costs while the absence of effective tax cover for new entrants has already been addressed as have the data, licensing and access to acreage and infrastructure issues while brown fields have been and are still being worked.

Mike Earp, DTI, 21 May 2005