Forecasting Ghana's Oil Revenues for the 2015 Budget

Using a Fiscal Model of the Jubilee Field

David Mihalyi

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In 2011, when Ghana exported its first shipment of oil from the Jubilee oil project, it also adopted state-of-the-art legislation to manage petroleum revenues. The aim of the law was to ensure that petroleum revenues are directed toward priorities related to investment in growth-promoting sectors, saving, stabilization and developing the oil sector.[1] The legislation sets out clear numerical rules to allocate resource revenues between these priorities based on projected revenues. In order to guard against the risks of substantial year-on-year price volatility, the Petroleum Revenue Management Act (PRMA) requires Ghana to allocate its distribution of oil revenues in light of a "benchmark revenue" formula based on a seven-year rolling average of past, current and expected oil prices. Combined with limits on the amount of revenue that can be spent in any given year and the requirement that surplus funds be deposited into the Ghana Stabilization Fund and the Ghana Heritage Fund, the benchmark revenue formula is designed to smooth the allocation of volatile oil revenues over a multi-year period.

Employing the formula mandated by the PRMA, the Ministry of Finance presented the 2015 budget in Parliament on November 19 with a benchmark oil price of $99 per barrel.[2] On the day that the budget was proposed, Brent crude oil was trading at $80/barrel.[3] Prices have subsequently dropped even further, to $60/barrel at the time of publishing. While we agree that it is crucial that the Ministry of Finance follows the law with regard to forecasting oil prices, the gap between the statutorily mandated benchmark price and the actual market trading price has been a source of confusion for some parliamentarians and Ghanaian citizens. In order to help parliament and the public understand the potential impact of falling prices on the implementation of the 2015 budget and the growth of the Ghana Petroleum Funds, we have built an oil revenue forecasting model for Ghana`s 2015. The tool uses only publicly available data and information. It is provided in Microsoft Excel (.xlsx), released under an open licence so that it can be used by anyone. It can also be edited and refined, allowing it to be updated as events in Ghana and the world evolve.

This modelling was only made possible due to the advanced state of oil sector disclosures in Ghana: Some contracts are published, the country is EITI-compliant, national laws require transparency and

[1] http://www.resourcegovernance.org/news/ghanaian-parliament-passes-revenue-management-bill
[2] http://www.mofep.gov.gh/sites/default/files/budget/Budget-Statement-2015_0.pdf
[3] See Annex 1 for excerpt from the Budget Speech on this issue.

regular reporting, and international oil companies such as Tullow and Kosmos disclose further key information.

Key findings

Our initial results suggest that implementation of the Petroleum Revenue Management Act can enable Ghana to successfully cushion shortfalls from revenue volatility during 2015. Because the Act mandates prudence when setting annual budgets, the government is likely to be able to cover its commitment to the annual budget even if prices drop.

According to our analysis, if the Brent crude oil price was to trade at $70/barrel throughout 2015,[4] as opposed to the $99/barrel benchmark price, actual petroleum revenue to the government would fall short by 31 percent or $430 million compared with our baseline scenario. As compared with the budget figure, the shortfall is projected at 23 percent or $281 million.

Our calculations show that the Annual Budget Funding Amount will be protected under a $70/barrel price scenario. The shortfall in revenue would affect GNPC negatively, allowing it to withhold $52 million less in revenues (a 25% reduction). The accumulation of revenues into the two funds would slow dramatically under the $70/barrel scenario: By our calculations, $24 million would accrue to the Ghana Heritage Fund in 2015, and $56 million would accrue to the Ghana Stabilization Fund (in both cases this figure is 74 percent lower than what would be obtained in a $99/barrel scenario).

Table 1 - Distribution of 2015 petroleum receipts ($ m)

	Total petroleum revenue	Ghana National Petroleum Corporation	Annual Budget Funding Amount	Ghana Heritage Fund	Ghana Stabilization Fund
Budget	1236	205	722	93	217
Jubilee Model at $70/barrel	956	153	722	24	57

[4] The U.S. Energy Information Administration (EIA)'s short-term energy outlook published on December 9, 2014, forecasts a Brent price for of $68.08 for 2015. http://www.eia.gov/forecasts/steo/report/prices.cfm

Other findings

- In order to test the accuracy of the model we built, we calculated backward-looking estimates to compare against actual. Our model successfully captures the dynamics of the steep increase in revenues observed between 2010 and 2013. It is also closer to actual receipts than were the benchmark figures provided by the government during the 2010–2013 budget processes. While this is encouraging, our model had the benefit of hindsight.
- We project that actual petroleum revenues in 2014 are likely to significantly surpass budget figures. This could further increase resources available in the Stabilization Fund, although it is currently capped at $250 million,[5] with additional receipts used for debt reduction.
- Further detailed data will be needed to refine the model and reconcile discrepancies. Most crucial would be data on debt and interest costs and on development costs during the 2013–2015 period. Data on debt and interest cost could help to ascertain whether companies engage in thin capitalization, which may reduce corporate tax payments. Data on recent development costs would help to ascertain to what extent costs of new field developments are being offset against taxes due for the Jubilee field.
- Our model also allows us to test further alternative scenarios, including different cost and volume scenarios. We encourage users to test the model and share findings but also feedback for improvement.

Disclaimer

This model comes with serious limitations as compared with those operated by government authorities, oil companies or the IMF/WB, as we have only used publicly available data. Although we are confident that it captures magnitudes and trends with a reasonable degree of accuracy, it may not be as precise as other models using proprietary or privileged information.

We will continue working with stakeholders in Ghana to refine the model as more open data becomes available.

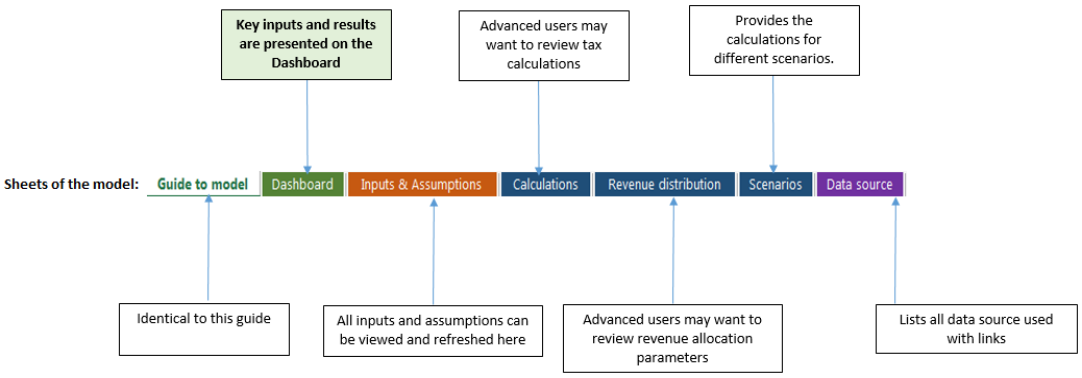
[5] http://www.mofep.gov.gh/?q=press-release/2014-06-02/re-parliament-must-investigate-spending-from-the-ghana-stabilisation-fund

Contents

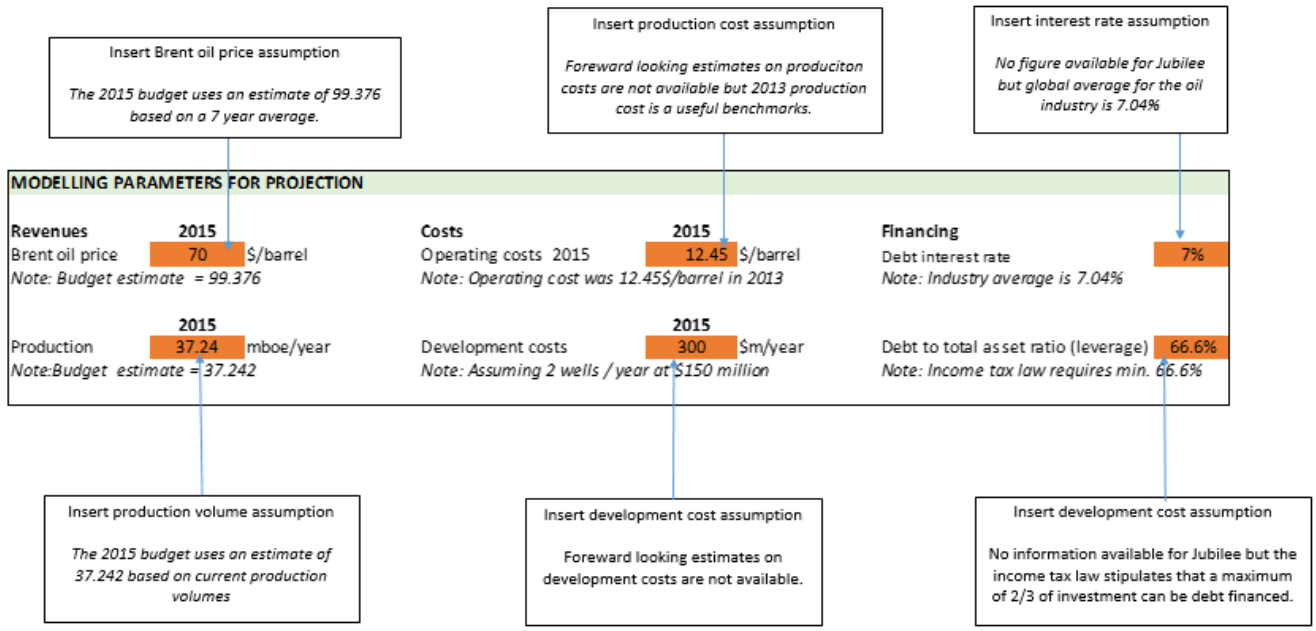
Using the Jubilee model: a guide

The open model of the Jubilee field runs using Microsoft Excel or a compatible spreadsheet tool. No additional plugins or macros are required.

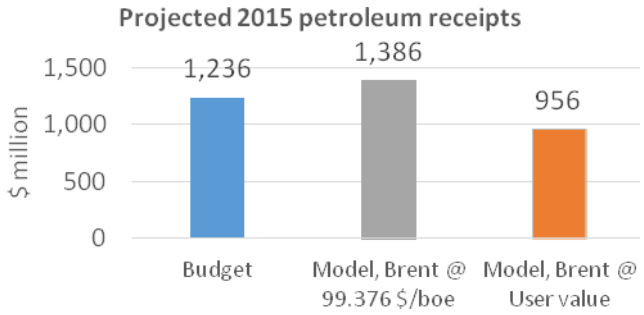
It allows users to input key assumptions and instantaneously see results for analysis, both graphically and numerically. The spreadsheet consists of multiple sheets, as shown in diagram 1 below.



The most important interface for using the model is the dashboard sheet, where users can input key assumptions and see how these affect petroleum receipts and their distribution.

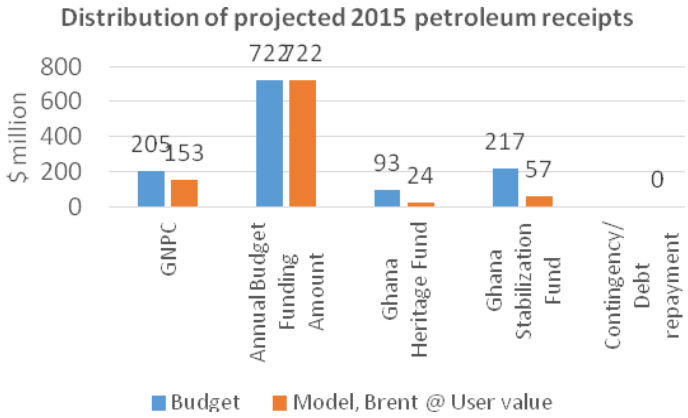


Results are also displayed on the dashboard tab below the box for input of parameters, and it refreshes automatically as users input values. It shows the budget figure alongside the model calculation at both the $99/barrel scenario used in the budget and the price inputted by the user on the dashboard.



The Jubilee model displays the projected effects of different scenarios on total petroleum receipts to the Government of Ghana in 2015 based on model calculations.

Results on the distribution of revenues are only shown for the model at user value alongside the original budget figure for more clarity.



The Jubilee model displays the projected distribution of petroleum receipts to the Government of Ghana in 2015 under different scenarios based on model calculations.

Sources of data and information

The following publicly available sources of data and information about Ghana`s oil industry were consulted for this analysis:

- Annual Report on the Petroleum Funds. Developed by the Ministry of Finance on an annual basis.
- Petroleum Receipts and Distribution Reports. Published quarterly by the Ministry of Finance.
- Report on Management of Petroleum Revenues. Drafted biannually by the Public Interest and Accountability Committee.
- Budget statement, budget speech and budget highlights published by the Ministry of Finance.
- Extractive Industries Transparency Initiative Report developed by the Ghana Extractive Industries Transparency Initiative (GHEITI).
- Petroleum Holding Fund & Ghana Petroleum Funds. Developed biannually by the Bank of Ghana.
- Kosmos Energy 10-K form to the Securities and Exchange Commission, U.S.
- Tullow Oil Plc Corporate Responsibility Report. Published annually.
- Resource contracts: The Petroleum agreements for the West Cape Three Points oil block and the Deepwater Tano oil blocks, on which the Jubilee field lies, and the Unitization and Unit Operating Agreement for the Jubilee field.

These sources of information were carefully reviewed, and relevant data was collated manually into a spreadsheet. The data was then used to build a simple project-level revenue forecast. Where multiple sources of information were available with minor discrepancies, we used the average of the different data points. No major discrepancy across the data sources listed above was found as part of this exercise. Where data was missing, we used simple assumptions to estimate values, as explained in the next section and in the accompanying spreadsheet.

Inputs and assumptions

The following list discusses the key assumptions used for the modelling. These include the assumptions and data sources behind volumes, sales prices, development, production and interest costs.

Volumes

The analysis relied on volumes lifted as reported by PIAC and daily production figures as reported by MoFEP for the period between 2011 and 2013 (Table 2). There is a small lag between production and lifting volumes, resulting in spillover barrels between years. While both production and lifting provide important insight into how the project is ramping up, we chose to use volumes of lifting as a basis for projecting revenues and expenditures, because those are more closely associated with the timing of tax payment. Projections for 2014 lifting are based on current production speed, and 2015 lifting projections are aligned with the benchmark volume estimated by MoFEP in the budget.

Table 2 - Petroleum volumes from Jubilee field

	2011	2012	2013	2014	2015
	Actual	Actual	Actual	Proj.	Proj.
Daily Production (boe/day)	66,290	71,997	99,685	103,000	102,033
Yearly lifting (mboe/year)	24.5	26.4	35.1	37.6	37.2

Sales prices

Each of the five companies[6] with equity stake in the Jubilee field sell their oil entitlement separately. Data on realized sales price across companies is not readily available, as not all companies disclose their sales prices. Hence we use a simple average of sales prices reported by the different companies for which data was available (Tullow, Kosmos and GNPC). We found that the sales price closely follows movements of the Brent crude oil price, at an average of 99.5 percent of Brent prices. We also found that the prices realized by GNPC are in line with the average Jubilee field sales price.

Our projection assumes that the gap between the Brent and Jubilee sales price remains at current levels.

For 2014, we project a Brent price of $101/barrel based on prices observed in the first nine months of the year, and an estimated average of $85/barrel[7] average for the last three months of the year. For 2015 our baseline scenario is one with Brent price at $99.4/barrel, as indicated in the budget based on the formula in the PRMA.

We also developed an alternative 2015 price scenario that is of particular relevance given current low oil prices, looking at the impact of Brent prices at $70/barrel (Table 3).

[6] GNPC, Tullow, Kosmos, Anadarko, Petro SA.
[7] The estimate for the last three months was taken from IMF commodity price outlook (November 2014).

Table 3 - Petroleum sales prices

	2011	2012	2013	2014	2015	2015
	Actual	Actual	Actual	Proj.	Baseline proj.	Alt. scenario
Brent price ($/barrel)	111.0	112.0	108.8	101.2	99.4	70.0
Jubilee sales price ($/barrel)	112.2	110.3	107.5	100.6	98.8	69.6

Development costs

We rely on data on exploration and development costs reported by PIAC in great detail for 2011–2012. For costs incurred prior to 2011, there is a total figure for the costs, but it is not further split up across years when it occurred. Hence we use a simplifying assumption to spread these costs equally between the three years since the beginning of field development.[8]

For development costs in 2013 and 2014 we assume that phase 1A is completed according to the Tullow estimate at $1.1 billion,[9] distributing the remaining balance of $424 after the 2012 spend on phase 1A evenly between 2013 and 2014.

The total development cost figure we use is $9.4 billion from the start of exploration to 2014, which includes exploration cost, development of phase 1 and phase 1A, and the purchase of the floating production, storage and offloading (FPSO) unit.

Starting in 2015, Tullow is planning to start an "incremental development consisting of additional infill wells and subsea infrastructure to further raise recovery and maintain plateau production levels," which will include 10-20 additional wells in five years.[10] Assuming three wells drilled in 2015 at a cost of $100 million,[11] we project a further $300 million in development costs for 2015.[12] This parameter can also be adjusted using the dashboard.

As shown in Table 4, we assume that the vast majority of development costs occurred until 2012 and that going forward, development costs will be relatively low. This is in line with the typical distribution of development costs of oil projects.

We also assume that no development cost from other upstream oil projects is being used to offset against taxes due for the Jubilee field. This is a simplifying assumption and might need to be revisited, given that there is no ring-fencing provision in the petroleum contracts. More recent detailed data on development expenditures could shed light on the extent to which this is happening, given that the development of the Tweneboa-Enyenra-Ntomme (TEN) field was started in 2013 by some of the companies who partner on the Jubilee field.

[8] The cost data provided by PIAC for 2013 is not detailed enough and is hard to reconcile with other evidence.
[9] http://www.tullowoil.com/ghana/index.asp?pageid=31
[10] http://www.tullowoil.com/index.asp?pageid=248
[11] http://www.offshore-technology.com/features/featurerisky-business-deepwater-drilling-north-sea/
[12] In the model we use development costs as a proxy for capitalised costs. In practice, some of the production cost might form part of capital expenditure, but will be treated as operating costs instead.

Table 4 - Jubilee development costs

	2008	2009	2010	2011	2012	2013	2014	2015
	Estim.	Estim.	Estim.	Actual	Actual	Estim.	Proj.	Proj.
Development costs (including exploration) $ m	1,383	1,383	1,383	1,680	1,474	212	212	300

Production costs

We use data on operating costs as reported in the 10-K form submitted by Kosmos to the Security and Exchange Commission (SEC) as part of its U.S. listing requirements. We find that operating costs have been varying between $12/barrel and $16/barrel.

We assume that production costs will continue at the reported low of $12.5/barrel from 2013 onwards. This parameter can also be adjusted using the dashboard for 2015.

Table 5 - Jubilee field production costs

	2011	2012	2013	2014	2015
	Actual	Actual	Actual	Proj.	Proj.
Production costs ($/barrel)	14.0	16.1	12.5	12.5	12.5

Interest costs and debt financing

A key piece of information for which there is no data available is the level of debt used to finance the project and the amount of interest cost deducted from it.

Because interest payments on loans are deductible for income-tax purposes, international oil companies sometimes finance subsidiaries in the countries of production with extremely high levels of debt in the form of related-party loans, which means that interest payments made from the subsidiary to its parent company can be deducted, limiting the subsidiary's tax liability. Governments can combat this problem by capping the level of debt that an oil subsidiary can take on in relation to its total capitalization, or by mandating that interest payments made on debt exceeding a certain debt-to-equity ratio will not be deductible for tax purposes.[13]

Because there is no disclosure of debt associated with the project, we look at the legal requirements as a benchmark. The amount of interest legally allowed to be deducted for Jubilee is unclear. The 2013 Ernst & Young Oil and Gas Tax Guide, based on the Internal Revenue Act, asserts that "Thin capitalization rules restrict the total debt and equity mix in a foreign-controlled entity for tax purposes. The permitted debt to equity ratio for tax purposes is 2:1."

But Joe Amoako-Tuffour and Joyce Owusu-Ayim (2010) maintain that this limitation does not apply to Petroleum operation. "The absence of any thin capitalization provisions in Ghana's PITL is a

[13] http://www.resourcegovernance.org/training/resource_center/backgrounders/oil-gas-and-mining-fiscal-terms

potential setback to government's ability to capture rent. While the Internal Revenue Act (IRA), 2000 (Act 592) contains a thin capitalization provision of 2 to 1 debt to equity ratio, that provision to date is not applicable to petroleum operations, nor is it enforced in the case of mining. "

We model using a 2:1 debt to equity based on the Ernst & Young Global Oil and Gas Tax Guide (2013) interpretation of the Internal Revenue Act (2000). The 2:1 debt to equity ratio is equivalent to a 66 percent ratio of debt to total assets (where assets = debt + equity). This parameter can also be adjusted using the dashboard.

The other key consideration is how high the interest on the loans is. Again, because we have no information on interest costs, we look at the law. The Petroleum Income Tax Act also stipulates that "Interest on loans from third parties are not to exceed the lowest market interest rates for similar loans" (Ernst & Young Global Oil and Gas Tax Guide 2013).

Based on this information, we look at the industry average as a benchmark. In a publicly available database of cost of capital we find that the pre-tax cost of debt for the petroleum industry (exploration and production) is 7.04 percent.[14] This could arguably be higher, given that the project is deep offshore and that it is the first such large investment in the oil basin. This parameter can also be adjusted using the dashboard.

We also assume that companies repay their loan as soon as they have a positive cash flow (revenues exceed costs). In practice, companies might have agreed on longer repayment periods for the loans.

Hence there is large uncertainty regarding these estimates. As noted by a 2013 World Bank report on revenues from the Jubilee project based on undisclosed information, "income tax realizations continue to be suppressed by accelerated capital allowances and intercompany interest deductions. The absence of ring-fencing and thin capitalization rules within the Petroleum Income Tax Law is largely to blame." [15]

Based on our projection, using a debt to equity ratio of 2:1, interest costs of 7.04 percent and repayment as soon as cash flow is available to companies, we estimate that debt would have peaked at $3 billion in 2010 and would be entirely repaid by the end of 2014.

Table 6 - Jubilee interest cost and debt

	2008	2009	2010	2011	2012	2013	2014	2015
	Estim.	Estim.	Estim.	Estim.	Estim.	Estim.	Estim.	Estim.
Interest payment ($m)	63	130	202	217	211	183	27	-
Debt (at end of year) ($m)	957	1982	3079	2992	2599	384	-	-

[14] Page XVI. http://pages.stern.nyu.edu/~adamodar/New_Home_Page/datafile/wacc.htm (January 2014 data)
[15] https://openknowledge.worldbank.org/bitstream/handle/10986/16264/796560WP0P13140Box0377384B00PUBLIC0.pdf?sequence=1

Actual petroleum revenues

Total petroleum revenue figures were taken from MoFEP and PIAC reports. They include royalties, surface rent, corporate tax and carried and participating interest. Total government revenue from the 2010–2013 period was $1833 million over 4 years (Table 7).

Table 7 – Actual petroleum revenues

Petroleum revenues ($ m)	2010	2011	2012	2013
	Actual	Actual	Actual	Actual
Surface rent	0	0	0	1
Royalty	0	123	151	175
Corporate income tax	1	0	0	217
Additional oil entitlement	0	0	0	0
Carried and paid interest	0	321	390	454
Gas receipts	0	0	0	0
Total revenue	**1**	**444**	**542**	**846**

Assumptions on modelling fiscal revenue flows

The model projects the revenue flows due to the government for 2014 and 2015. As an accuracy check, it also estimates what payments should have accrued under the model's assumptions from 2010–2013.

Royalties

Royalties are modelled as 5 percent of the estimated value of yearly crude oil lifting. The estimated value of crude oil lifting in turn was estimated as the total volume of oil lifted multiplied by the average sales price.

Corporate tax

The following assumptions are used as part of the projection of corporate tax:

- Calculated as 35 percent on taxable income after losses based on the rate in petroleum agreements.
- Taxable income after losses is calculated as follows: net revenues – operating costs – capital depreciation – interest costs – prior losses carried forward.
- We use development costs as a proxy for capitalized costs. In practice, some of the production cost might form part of capital expenditure, but it will be treated as operating costs instead. Capitalized costs are depreciated over a five-year period in equal proportions (/5 year straight line depreciation) as defined in Petroleum Income Tax Law.
- Unlimited losses carried forward as defined in Petroleum Income Tax Law.
- No deduction of any additional exploration or new development (as if project was ring-fenced).[16]
- We introduced a quarterly lag between tax payable for a fiscal year and tax paid in a calendar year. This follows Petroleum Income Tax legislation.

Additional oil entitlement (AOE)

Modelled as per the petroleum agreement on cumulative cash flow after all other taxes. This tax is first expected to be paid once after-tax investor returns exceed 19 percent in real terms (after adjusting for inflation). According to our projection, even in our baseline scenario ($99/barrel) investor returns after tax will only reach 11 percent by 2015, hence no AOE payment is expected.

Carried and participating interest through GNPC

The government receives a share of production through GNPC based on its carried and participating interest. In exchange for its 10 percent carried interest, based on the petroleum agreement, it receives 10 percent of production in kind, after deducting production costs proportionally (but not development costs). GNPC also decided to acquire 3.75 percent in participating interest, for which it receives a share after deducting both production and development costs proportionally. GNPC`s

[16] This is a simplifying assumption that involves considerable risk, as actual ring-fencing rules allow deducting costs from other upstream projects, as discussed under development cost section. No information is available about whether such deductions are being done.

share of participating interest was reduced to 3.64 percent following a determination process in 2011.[17] Our projection assumes that the share of GNPC remains constant in the projection period.

Unfortunately, GNPC does not publish annual reports, hence we also had to make some simplifying assumptions about GNPC's finances. Our model assumes that GNPC accumulated debt on the full extent of its participating interest before production started and is now repaying it with interest costs of 2 percent (Libor + 1.5 percent) as per the petroleum agreement. Given the lack of information on debt outstanding and plans to pay it down, we use the simplifying assumption that GNPC will continue to pay for its yearly share of equity costs in full, as well as interest, but not pay down any previous debt. This would be in line with GNPC`s current strategy of expanding and trying to raise further debt, especially given how advantageous the terms of its debt to Jubilee partners are.[18]

Revenue streams not modelled

For some revenue streams we did not find sufficient information to model revenues expected, hence defaulted to use the government's 2015 budget estimates. These include gas receipts, surface rents and royalties from Saltpond. According to government budget estimates these represent 6.9 percent of petroleum receipts.

Gas receipts: Gas receipts were included in government projections in 2013 and 2014 but failed to materialize until September 2014 due to delays in developing the gas infrastructure. There is not sufficient information available on the costs and revenues associated with the gas project and no contract has been published. Hence it is not possible to model revenues from it using open data.

The gas plant has started operations in December 2014 and is now producing LPG for the domestic market[19]. According to the Gas Market Plan for Ghana the first 200 billion cubic feet of gas is free as part of the agreement with the jubilee partners[20]. But due to the lack of sufficient information for modelling we default to using the $84.2 million estimate put forward in the 2015 budget.

Royalties from Saltpond: There is not sufficient information available on the costs and revenues associated with the Saltpond oil field, and no contract has been published. Hence it is not possible to model revenues from it using open data. The magnitude of revenues from Saltpond is small, hence it also represents a smaller risk to the budget.

The 2015 budget again includes a projection of revenues (royalties) from the Saltpond oil field of $0.2 million. We therefore defaulted to use the estimate put forward in the budget.

Surface rent: Although revenues from surface rent could be potentially modelled, we judged that its order of magnitude and observed variance is small enough to default to using the estimate put forward in the budget of $1.4 million.

[17] "Three Years of Petroleum Revenue Management in Ghana" – ACEP (2014)
[18] http://www.myjoyonline.com/business/2014/December-13th/parliament-okays-gnpc-deal.php
[19] http://graphic.com.gh/news/general-news/35532-atuabo-plant-supplies-domestic-market-with-gas.html
[20] Gas Master Plan for Ghana, Draft Final Report submitted to the Min of Energy and Petroleum 2014. p 51.

Modelling revenue distribution

We model revenue distribution based on the Petroleum Revenue Management Act (PRMA).

Ghana National Petroleum Corporation (GNPC)

Based on the PRMA, GNPC receives equity financing costs and a share of carried and participating interest net of equity costs maximized at 55 percent. In November 2013, pursuant to its authority under Section 7(3b) of the PRMA, parliament decreased GNPC`s maximum allowable share of the carried and participating interest net of equity financing costs from 40 percent to 30 percent for 2014–2016.

The remainder of revenue is accumulated in the Petroleum Holding Fund, to be divided between the Annual Budget Funding Amount, the Ghana Heritage Fund and the Ghana Stabilization Fund.

Annual Budget Funding Amount (ABFA)

The PRMA limits the maximum share of benchmark revenue that can be allocated to the budget every year as a way to protect the budget from shocks. Under the PRMA, this Annual Budget Funding Amount (ABFA) is capped at the amount set in the budget, which in no case can exceed 70 percent of benchmark revenue. In the case of a shortfall, money can be withdrawn from the Ghana Stabilization Fund (GSF) to cover up to 75 percent of the shortfall, so there are sufficient revenues in the GSF to do so. While the PRMA provides for withdrawal and saving on a quarterly basis, the model only calculates differences for the full year.

The 2015 budget is based on a proposal to set the ABFA at the maximum level of 70 percent of benchmark revenues, or $722 million.

Any surplus petroleum revenues above this $722 million figure would be saved in the Ghana Heritage Fund and the Ghana Stabilization Fund. In case of shortfall, only the GSF will be affected, not the GHF.

Ghana Stabilization Fund (GSF)

Seventy percent of any surplus above the ABFA compared with the receipts available in the PHF are saved in the GSF. Seventy-five percent of any shortfall to the ABFA compared with the receipts available in the PHF is withdrawn from the GSF, subject to not exceeding the balance of GSF at the beginning of the year (25 percent of the balance each quarter).

The PRMA also allows for a cap to be set on the GSF (Section 23(3)). In 2014, the cap was set at $250 million for the year. The cap was reached during 2014 as a result of large surplus revenues. We assume that the GSF will close the year at the level of current cap: $250 million. The 2015 budget statement increases the cap to $400 million at the end of 2015. Any surplus revenues to the GSF beyond the cap are directed toward contingency and debt repayment. The balance of the Ghana Stabilization Fund and at what level its cap is set is crucial in determining how large revenue shortfalls can be mitigated.

Ghana Heritage Fund (GHF)

Thirty percent of any surplus above the ABFA compared with the receipts available in the PHF is saved in the GHF. In case of shortfall, no receipts are saved in the GHF. If petroleum wealth is depleted, funds from the GHF can be withdrawn, but we do not model this option.

Results from the model

Historical accuracy of the Jubilee model

Here we present the results of estimates of petroleum receipts based on the Jubilee model for the past years against actual and budget figures.

Projecting petroleum revenues has proven to be a major challenge and source of controversy in Ghana since the law came into force. In 2011 and 2012, budget projections of oil revenues included estimates of large corporate tax payments that did not materialize, as companies were continuing to deduct losses incurred in previous years.[21] In 2013 and 2014, budget projections included gas receipts that failed to materialize due to delays in project execution. But in both years this shortfall in gas revenue has been more than offset by larger than projected corporate tax payments, as oil companies have now recovered their previous losses. In 2011 and 2012, the shortfall of revenues against projections led to lower-than-expected accumulation of funds into Ghana's funds for stabilization and for future generations (the Ghana Stabilization Fund and the Ghana Heritage Fund, respectively). In 2013 and 2014, when revenues had exceeded projections, the government`s concern was that too much might be going into the funds, hence it resorted to cap the fund.[22] Off-target projections can seriously undermine the effectiveness of the revenue management system, as it skews the distribution between priority areas. Hence the Public Interest and Accountability Committee—an institution created by the revenue management legislation to provide public monitoring of implementation of the act—has called upon the government to improve revenue forecasts.[23]

As shown in Figure 1, the Jubilee model successfully captures some of the dynamics in how revenues grew between 2010 and 2013. The difference between the model estimates and actual figures are $52 million or 12 percent in 2011, -$18 million or -3 percent in 2012, and -$82 million or -10 percent in 2013.

They are also closer to actual figures than the original budget figures. While this is encouraging, it is important to acknowledge that our model did have the benefit of hindsight.

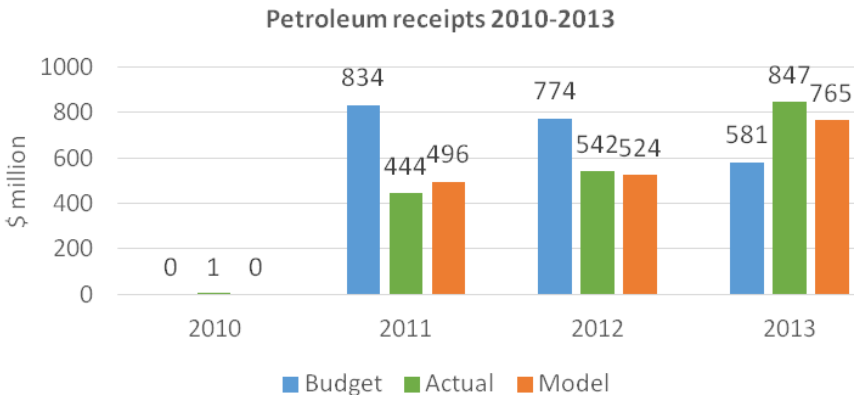


Figure 1 - Petroleum revenues 2010–13

[21] "Three Years of Petroleum Revenue Management in Ghana" – ACEP (2014)
[22] Ibid.
[23] PIAC 2013 Annual Report

2014 projections

Regarding 2014 revenues (Figure 2), our projections are much higher than the budget figure (+64 percent). According to the budget speech read in parliament, actual petroleum revenues have already surpassed the budget figure by September, hence we are cautiously optimistic that our projections might end up closer to the actual 2014 petroleum revenue than the budgeted figure. This surplus would have further increased resources available in the Stabilization Fund, but given that its current cap at $250 million[24] was already reached, additional receipts will be used for debt reduction.

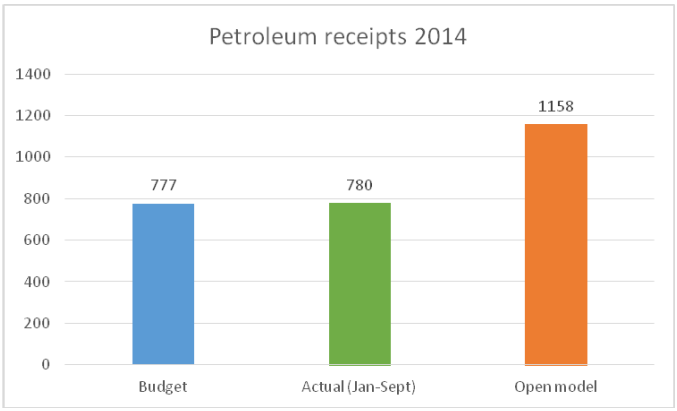
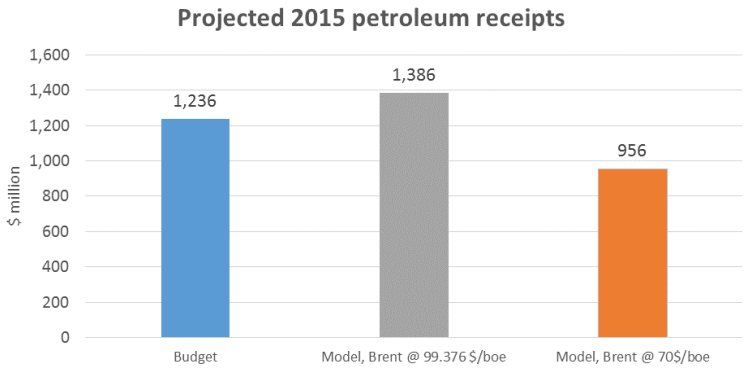


Figure 2 - Petroleum revenues 2014

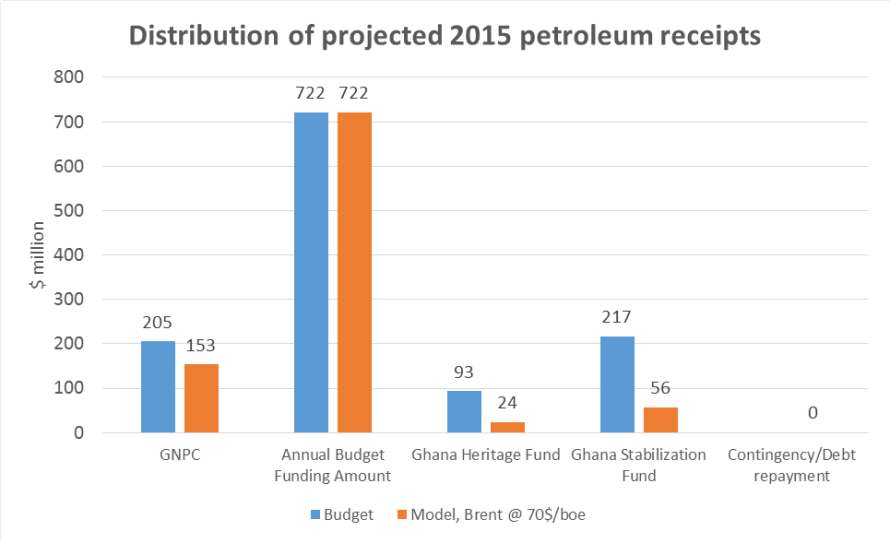
2015 projections

For 2015 we estimated revenues based on two scenarios (Figure 3). One is based on a Brent oil price of $99/barrel, as used in the budget and based on the seven-year average as defined in PRMA. We then calculated what would be the revenue implication if oil prices were to stay at $70/barrel (Brent) based on recent price developments. Our analysis estimates that the shortfall in revenues in the $70/barrel price scenario would be $430 million (-31 percent), compared with our baseline projection of $99/barrel. As compared to budget, the shortfall would be $281 million (-23 percent).



[24] http://www.mofep.gov.gh/?q=press-release/2014-06-02/re-parliament-must-investigate-spending-from-the-ghana-stabilisation-fund

The model also shows what the implications of such a shortfall would be based on the provisions of allocation in the Petroleum Revenue Management Act and the parameters laid out in the budget.



Our calculations show that the Annual Budget Funding Amount will be protected under a $70/barrel price scenario. The shortfall in revenue would affect GNPC negatively. GNPC's revenue retention is limited to a maximum of 30 percent of net carried and participating interests. Because a drop in prices would cause a drop in these net carried and participating interests, GNPC's earnings would be lower than is projected in the budget by $52 million (a 25 percent reduction). The accumulation of revenues into the two funds would slow dramatically under the $70/barrel scenario: By our calculations, $24 million would accrue to the Ghana Heritage Fund in 2015, and $56 million would accrue to the Ghana Stabilization Fund (in both cases this figure is 74 percent lower than what would be obtained in a $99/barrel scenario).

The author would like to thank those who contributed to the Jubilee model: Dr. Mohammed Amin Adam, Andrew Bauer, Samuel Bekoe, Jim Cust, Patrick Heller, Emmanuel Kuyole, Thomas Lassourd, David Manley, Dr. Keith Myers, Anders Pedersen.

Annexes

Annex 1: Budget statement (excerpt)

164. Mr. Speaker, Government is fully aware of the continuous decline of crude oil prices and its implications for our fiscal position for the rest of 2014 and 2015. Dated Brent price declined from a January average of US$107 to US$104 in July and below US$90 per barrel in October 2014. In the early part of November, Dated Brent hit a four-year low, reaching below US$80 per barrel. This has serious implications for the 2015 Budget as petroleum revenues could underperform if prices do not pick up to the level of the projected price.

165. Mr. Speaker, the fact that the PRMA sets out the formula for calculating the benchmark price makes it difficult to set the projected price aside, since that could be tantamount to a violation of the Law. Indeed, Government did not revise the projected prices for 2011–2014 in spite of indications at the time that actual prices would be higher than projected.

166. Consistent with Section 12 of the PRMA, shortfalls in petroleum revenue emanating from unexpected volume or/and price declines are mitigated by the withdrawals from the Ghana Stabilization Fund. Thus, if crude oil prices remain below the benchmark price, the GSF will be used to augment the ABFA, in line with the PRMA.

Annex 2: Sources

Data category	Main finding	Sources
General legislation and contracts	Contracts and key laws are available online.	Oil sector legislation Unitization and Unit Operating Agreement – Jubilee Field Unit Tullow petroleum agreement Kosmos petroleum agreement Further Agreements
Reserves and resources • Developed • Undeveloped • Proven • Undiscovered	A wide range of estimates.	Estimates of undiscovered reserves are available for Gulf of Guinea region from USGS. Proven oil and gas reserves from EIA 1980–2013. Proven and developed reserves data from the operator of Jubilee (Tullow)
Oil and gas volumes produced and lifted	Data on Jubilee field volume is available from multiple sources. EIA has more aggregated data for the sector. This was not used for this analysis.	GHEITI, MOFEP, PIAC, GNPC EIA
Oil sales price	Data is not systematic but useful to calculate average price compared to reference price.	GNPC, Kosmos and Tullow disclosed revenue information.
Industry costs • Production costs • Development costs	Data is available for both operating cost and capital costs on Jubilee. There is no clear proof that these sources cover all costs relevant for taxation.	Kosmos disclosed production costs to the Security and Exchanges Commission on the 10-K form. PIAC disclosed development costs from the start of exploration to 2012.
Government taxes and royalties	Project level tax data available. Company-level Jubilee data from EITI, Tullow and Kosmos.	GHEITI, MOFEP and PIAC provide project level revenue data. GHEITI provides company level data for 2011. Tullow provides company-level details of payment, 2010-2012, 2013. Kosmos provides 2013 Ghana payments.

Private company pre- and post-tax profits	Companies report on a consolidated basis.	N/A
National oil company data	No company annual report from GNPC. Revenue: Detailed data on volume of oil lifting. No sufficient data on assets and liabilities of the company.	GNPC provides volume data for 2011–2013 GHEITI, MOFEP and PIAC provide more detail on sales price and costs. Assets: Limited information on assets. Besides the stakes in exploration and production oil assets, GNPC also holds interest in diverse other companies, including mobile, motel and goldmine. Liabilities: No up-to-date full picture.

Annex 3: Further links

Amoako-Tuffour and Owusu-Ayim (2010), "An Evaluation of Ghana`s Petroleum Fiscal Regime" http://ieagh.org/wp-content/uploads/2014/07/gpj-v4-art1.pdf

Bank of Ghana http://bog.gov.gh/

Bell, Heller and Heuty (August 2010), "Comments on Ghana's Petroleum Revenue Management" http://www.resourcegovernance.org/news/ghanaian-parliament-passes-revenue-management-bill

Ernst & Young Global Oil and Gas Tax Guide 2013 http://www.ey.com/Publication/vwLUAssets/2013_global_oil_and_gas_tax_guide/$FILE/EY_Oil_and_Gas_2013.pdf

Further petroleum agreements http://goxi.org/profiles/blogs/ghana-oil-contracts-disclosed

Ghana EITI http://www.gheiti.gov.gh/

Key oil contracts from Ghana http://www.resourcecontracts.org/#documents?search=ghana

Kosmos Energy http://investors.kosmosenergy.com/phoenix.zhtml?c=238878&p=irol-reportsannual

Ministry of Finance, Government of Ghana (MoFEP) http://www.mofep.gov.gh/?q=reports

Public Interest and Accountability Committee (PIAC) http://piacghana.org/

Oil/Gas (Production and Exploration), pre-tax cost of debt. Based on S&P Capital IQ, Bloomberg and Fed data (retrieved Janurary 2014). http://pages.stern.nyu.edu/~adamodar/New_Home_Page/datafile/wacc.htm

"Three Years of Petroleum Revenue Management in Ghana," ACEP (2014) http://www.aceplive.com/wp-content/uploads/2014/08/ACEP-Report-PRMA-Final.pdf

Tullow Corporate Responsibility Reports http://www.tullowoil.com/index.asp?pageid=358

World Bank (2009), "Economy-Wide Impact of Oil Discovery in Ghana" http://siteresources.worldbank.org/INTGHANA/Resources/Economy-Wide_Impact_of_Oil_Discovery_in_Ghana.pdf

World Bank (2013), "Energizing Economic Growth in Ghana: Making the Power and Petroleum Sectors Rise to the Challenge" https://openknowledge.worldbank.org/bitstream/handle/10986/16264/796560WP0P13140Box0377384B00PUBLIC0.pdf?sequence=1

Annex 4: The pros and cons of forecasting revenues from the Jubilee Ffeld using an open model and open data

Pros	Cons
Jubilee field contracts as well as the unification agreement are publicly available. Some of the license holders are listed on the Ghana, London and New York stock exchanges and are required to disclose financial information regularly. Tullow implemented additional voluntary project-level disclosures via its annual reports ahead of EU regulations coming into force. Ghana is EITI compliant and EITI reports provide additional information compared with basic requirements. There are strong reporting rules on oil revenues to parliament in the Revenue Management Act, leading to detailed reports published by the Ministry of Finance and PIAC. Jubilee represents a major project with significant implications for governance revenues and budgeting (6.5 percent of budget revenues in 2014). Jubilee provides more than 95 percent of oil production in Ghana, so project level data is (at present) a close approximation to national-level data. Ghana has a relatively open and free environment, where general data and information is mostly available and relatively reliable.	The field only started producing in 2010 and has yet to reach its peak. An increased length of time series data would increase robustness of projections. The NOCs role (GNPC) is ambiguous: a license holder in the field, collecting revenues, selling oil but with a mandate to develop the oil sector. Fiscal modelling alone might overlook some of the benefits and costs associated with GNPC. The modelling needs to make simplifying assumptions on the strategy employed by GNPC based on very limited information disclosed by the company. Lack of strong ring-fencing rules. The current fiscal terms provide incentives for the companies to reinvest some of their return into further exploration. The current modelling overlooks this opportunity based on the lack of information on the topic. There are multiple license owners in the Jubilee field, and there have been some changes in ownership distribution over the past years. The redetermination of ownership might affect the profits and losses of all other license holders. There is risk related to enforcement of tax laws. The model does not take into account any deterioration or improvement of tax enforcement.