

# About natural gas and dwellings in Groningen

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## 1. Introduction

This paper is a response to two recent developments in the Netherlands. Last year the Ministry of Finance requested that Statistics Netherlands compile a balance sheet for the Dutch state according to ESA 2010 guidelines. The purpose of this balance sheet is to cover all financial and non-financial assets and liabilities of the Dutch state and to provide a comprehensive overview of the state's net worth. It is foreseen that the balance sheet of the state will be included in next year's (2020) national budget as presented at 'Prinsjesdag' (Little Prince's Day on the third Tuesday of September). On this day the reigning monarch of the Netherlands addresses a joint session of the Dutch Senate and House of Representatives to give a speech, setting out the main features of government policy for the coming parliamentary year.

In accordance with legal ownership principles as laid down in the Dutch Mining Law, in the Dutch national accounts, the government has been identified as the sole economic owner of all energy resources in the Netherlands. Nevertheless the risks and rewards of energy extraction appear to be shared between the government and parties in the non-financial corporations sector. Under the current SNA it is difficult to envisage a scenario where mineral reserves could be recorded other than on the balance sheet of the legal owner, which in most countries will be the government. As this paper will go on to argue, this does not sit easily with resource rent calculations showing resource rent accruing to the lessee or user of natural resources.

A full assignment of economic ownership of energy resources to the Dutch state leads to an overstatement of the government's net worth. As a subsector of the government sector, this overstatement is more significant in the accounts of the state than in those of the entire government. Economic ownership of natural resources and related income and wealth allocation aspects have long been discussed (SEEA-CF 2012, 5.5.5). The Dutch case may shed new light on the issue.

The second development concerns the earthquakes in Groningen (a province in the north of the Netherlands) which are the undesirable effects of ongoing extraction in the Groningen gas field. As a consequence the Dutch government decided in 2018 to substantially diminish and then phase out extraction altogether by 2030.<sup>2</sup> As 'each disadvantage has its advantage' (van Hanegem, 31 March

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<sup>2</sup> On the 10th of September 2019 the Dutch government announced to terminate gas extraction in Groningen already by 2022 instead of 2030. The analyses presented in this paper take the 2030 date as point of reference.

1971, De Telegraaf: a former soccer player in the Feyenoord team)<sup>3</sup>, at this point in time we can retrospectively examine how accurate asset values were estimated in the past, of course given the current state of knowledge.

Obviously this knowledge also includes the damaging effects of the earthquakes. Conceptually the environmental accounts should provide a fair reflection of the resource rent, that is, excluding all current and future costs of extraction. The question is whether decommission costs require a different accounting treatment from the costs associated with compensation payments, the latter being ignored in the SEEA-CF and the SNA 2008.

Both issues are covered in separate sections of this paper. The paper winds up with suggestions for future work.

## 2. ‘Het Gasgebouw’ (The Gas Building)

### *Measuring output*

Het Gasgebouw is not a real building but stands for the cooperation between the Dutch state, the Dutch Oil Company (Nederlands Aardolie Maatschappij: NAM) and GasTerra in the extraction and distribution of natural gas” ([www.nam.nl](http://www.nam.nl); in Dutch) in Groningen. The NAM is a joint venture between Shell and ExxonMobile. GasTerra is a wholesaler in natural gas which is owned by Shell (25%), ExxonMobile (25%) and the Dutch state (50%). It’s share owners have agreed to set the annual profits of GasTerra to approximately € 40 million, irrespective of realized trade volumes or trade margins. The Gasgebouw is not a unique Dutch invention. A similar kind of arrangement between government entities, public and private companies is found in the Norwegian oil and gas mining industry and may exist in other countries as well.

The Maatschap Groningen (60% participation NAM and 40% EBN) was established with the purpose of co-managing the natural gas field in Groningen. A “Maatschap” is a partnership between two or more persons or institutions, called partners. Partners are supposed to share common interests by putting labour and capital to the disposal of a joined operation. The Maatschap Groningen assures that for the Groningen gas field specific arrangements apply, also with respect to the resource revenue allocation.

As a state owned incorporated enterprise EBN is overseeing the state’s interest in all Dutch oil and gas mining operations. As a non-operating partner, EBN is participating in virtually all oil and gas projects in the Netherlands. EBN’s interest in these activities varies from 40 to 50% ([www.ebn.nl](http://www.ebn.nl)). The annual business report 2018 mentions the joint arrangement for each gas field between EBN and private partners take the form of non-operated ventures (NOV). This implies EBN is a partner in all Dutch mining projects, however without being responsible for daily operations. In a joint operation, the operators have (both) rights to the assets and obligations for the liabilities (IFRS 11).

EBN’s annual statement 2018 reports sales from business operations of €3.0 and €2.7 billion in 2017 and 2018 respectively. EBN is a company with a staff of 110 high-skilled employees. Its annual report

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<sup>3</sup> The origin of this quote was wrongly assigned to Johan Cruyff, a former soccer player in the Ajax team.

mentions being active in the following areas: mineral exploration, reuse and decommissioning of old pipelines, developing and deploying know-how and managing participations in oil and gas companies.

In the Dutch national accounts EBN is currently classified as an administrative body in the government sector. Its output is valued at the sum of production costs. The key point under consideration is EBN's lack of autonomy of decision. Government involvement in the entity's operation appears to go beyond a shareholder's capacity to determine general corporate policy. For example, EBN is not allowed to enter into certain contracts without authorization from the Dutch state. Further, EBN was not a party in the recent agreement between the NAM and the state to lower future gas extractions. As a consequence EBN's identification as a self-standing institutional unit is problematic.

Even without autonomy of decision, EBN seems to share some of the characteristics of a 'factoryless', or more precisely a 'rigless', gas mining corporation. The conceptual background of factoryless goods producers (FGPs) can be found in the UNECE Guide on Measuring Global Production (2015). FGPs are typically active in the non-transformation shackles of a production chain: e.g. supply-chain management, R&D, product design, marketing and financing. Factoryless producers are encountered within the manufacturing industry but could also show up in the mining industry. Together with the partners Shell and ExxonMobil, EBN co-participates in Dutch mining operations and shares (on behalf of the state) part of the risks and rewards. EBN is typically active in the non-operational parts of the production chain, specifically dealing with the intellectual property product inputs (mineral exploration) and managerial activities. Depending on evidence found elsewhere, an upcoming decision on the classification of FGPs should also address the rigless producers within mining.

The following question answered in the remainder of this section is: who is (or are) the economic owner(s) of Dutch natural gas resources? The SNA 2008 and SEEA-CF 2012 explain how economic ownership must be assigned to the entity obtaining the rewards and bearing the risks associated with the asset's economic use. An assessment of rewards and risks associated with Dutch gas exploration is presented below. But first of all it is important to stress that the Dutch mining law identifies the state as the *legal* owner of all natural resources in the ground. As explained in the SNA 2008 (10.6) legal and economic ownership are not always the same thing. The SNA 2008 continues explaining (10.7) "when government claims legal ownership of an entity on behalf of the community at large, the benefits also accrue to the government on behalf of the community at large. Thus government is regarded as both the legal and economic owner of these entities." However, this reasoning does not seem to align very well to the case of Dutch gas resources ownership. The SNA 2008 also explains (13.3) that in the case of a natural resource lease the asset continues to appear in the balance sheet of the lessor even though most of the economic risks and rewards of using the asset in production are assumed by the lessee.

Chapter 17 (par's 17.313-17.315) put much emphasis on the length of natural resource extraction contracts (covering the asset's full service life or only parts of it). The entanglement between public and private parties in extraction arrangements is given less thought. So a key question is whether or not a shared asset recording is compatible with SNA 2008. The SNA argues (17.347) that "sharing the risks and rewards of an asset between different units at a point in time is unusual". Our impression is the existence of sharing of assets is less unusual than perhaps desirable from an accounting point of

view. SNA (17.347) introduces the concept of unincorporated joint ventures (UJV) where members share assets equally and ownership of the assets is shared in proportion to ownership shares of the UJV. One possible solution could then be to recognize an unincorporated joint venture between the government and private oil companies, record an asset transfer of the oil and gas reserves between government and the UJV and then record ownership of the assets including the oil reserves on basis of shares in the UJV. In the Dutch case, applying the UJV accounting option would probably be within scope of the current SNA. A perhaps undesirable consequence would be that natural resource ownership is now fully assigned to the non-financial corporations sector. And in the SEEA context, this routing still does not support the proper breakdown of natural resource depletion by sector.

Statistics Canada (2013) seems to be confronted with similar accounting challenges. In the Canadian situation the financial lease arrangement as proposed by the SNA 2008 is not necessarily according to economic reality and could lead to a significant distortion of the government net debt. Colleagues from Statistics Canada hesitate to split the ownership of natural resources by sector in physical and monetary terms. However, they suggest introducing a supplementary asset category 'intangible assets related to natural resources' which allows for a breakdown of resource ownership between the mining companies and the government in the Canadian natural resources accounts by institutional sector.

The SEEA-CF 2012 neither seems to provide much guidance on this topic. This is unfortunate as the national statistical institutes of other countries may be confronted with the issue of shared economic ownership of natural resources as well.

### *Assessing economic ownership, rewards*

Table 1 shows how in the case of the Netherlands the rewards of gas mining, i.e. the resource rents, are shared between the government and the mining corporations.

After, subtracting current and capital costs, in 2017 the combined gas/oil resource rent equals €3.6 billion. The table shows oil mining is only a minor activity in the Netherlands relative to gas mining.

Based on the indicated 40% involvement, EBN would directly obtain a resource rent of €1.5 billion. This amount is remarkably close to EBN's dividend payments in 2017 to the state. EBN's share in total sales (€3 billion) is 27% which is below the 40%. This may be due to non-operational profits/losses. Anyhow, the income generated by EBN, including the resource rent, will accrue to the state.

The so-called "surplus revenue regulation" (meeropbrengsten regeling) guaranteed that 'surplus' revenues of the NAM, for example due to rising gas prices, will be appropriated by the state. This regulation, which specifically applied to the Groningen gas field, led in 2017 to an additional €1.2 billion resource income to be allocated to the Dutch state. In 2018, the "Meeropbrengsten regeling" was replaced by another agreement between the state and the NAM, leading for the coming years to smaller shares of revenues going to the government.<sup>4</sup> But the most important outcome of this agreement was that in Groningen 70 billion euros worth of natural gas will remain in the ground.

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<sup>4</sup> <https://www.rijksoverheid.nl/documenten/kamerstukken/2018/06/25/kamerbrief-akkoord-op-hoofdpijnen-met-shell-en-exxonmobil>

Before corporate taxes the total government appropriation of the resource rent thus equals 73%, and after taxes almost 80%.

**Table 1**  
**Resource rent allocation in the Netherlands, 2017**

	<i>mln €</i>	
Output, extracted oil and gas	11232	
Intermediate consumption		4243
Compensation of employees		769
User costs of capital		2579
Resource rent*	3641	
o.w. Gas	3533	
o.w. Oil	108	
Share EBN**	1456	
Share NAM	2185	
o.w. 'Meeropbrengstregeling'***	1202	
Share Dutch State (S.13)	2658	73%
Share non-financial corporations (S.11)	983	27%
Share Dutch State after corporate taxes	2876	79%

\*National accounts, detailed calculations

\*\*Based on a 40% share as obtained from the EBN annual statement (2017)

\*\*\*NAM annual statement (2017)

### ***Assessing economic ownership, risks***

The risks of gas mining operations are diverse. Regarding the risk of fluctuating market prices for gas, these will in the Dutch case in a similar way affect the government as the mining companies in the non-financial corporations sector. Another form of risk, or liability, resembles the decommissioning costs borne after mining operations are terminated. Both the NAM and EBN have provisions on their balance sheet to cover future obligations to decommission the facilities on depleted gas fields.

In the case of the Netherlands, probably the most apparent form of risk is connected to the damages on dwellings and buildings from earthquakes resulting from gas mining in Groningen. The NAM's balance sheet shows provisions for these expected costs too. The above referred to agreement mentions that both the state and the NAM will continue taking responsibility for future compensation of damages.

### ***A tentative conclusion***

In the case of the Netherlands a large part of the governments' appropriation of the resource rent is being enforced by the governments' participation in all gas mining activities via the EBN. The allocation of resource rents presented in table 1 show that a smaller, but still a significant, share of the revenues are obtained by the private mining companies. This indicates de-facto a shared economic ownership.

It has been argued that the Dutch government has strong decision power in setting extraction levels. This hints at the Dutch government having ultimate control over gas resources. However, the decision

in 2018 not to extract a substantive part of remaining gas reserves in Groningen could only be the outcome of intensive negotiations between the state and the NAM. In fact, the concerned letter of the minister of economic affairs to the parliament explicitly mentions the NAM was under the former regime considered the owner, while after the new agreement the state takes control over the Groningen gas field. As a consequence the state also takes full responsibility of possible future criminal prosecutions<sup>5</sup>

Table 2 provides a sector accounts presentation of the resource rent allocation in the Netherlands. Based on this table the following observations can be made:

- Regardless of the classification of EBN (S.13/S.11001), the government sector will be not engaged in the production of natural gas. All gas mining related output must be recorded in the accounts of the non-financial corporations sector;
- Although the resource rent can be properly defined in the production account (i.e. the surplus generated income that cannot be assigned to fixed assets), in the income distribution accounts the resource rent may be encapsulated in various transaction categories and thus not directly identifiable as such. This point was already made by Van der Berg & Van de Ven (2001) in their analysis of the government appropriation of the resource rent. As the single owner of EBN, the state will be the recipient of its generated income. Dividend payable by EBN to the Dutch state is in the Dutch national accounts recorded as rent (D.45). As in the Dutch national accounts EBN is not recognized as an institutional unit, its income is in the accounts directly recorded as rent in the income account of the government. The same holds for the surplus income of the NAM appropriated by the government.
- One could even argue that part of the corporate taxes payable by the NAM includes in fact a portion of the resource rent appropriated by the government. But defining its size would be rather speculative and is therefore not pursued. This brings us to another point. Table 5.5 in the SEEA-CF 2012 shows that the resource rent is estimated as the residual income in the gross operating surplus after subtraction of (i) the user costs of fixed assets and (ii) extraction related taxes. In other words, corporate taxes are included in the resource rent which will subsequently accumulate in natural resource asset values. The (implicit) accumulation of tax revenues in the balance sheet of the government is not something the SNA would recommend us to do;
- The accounts show that the gross disposable income of the non-financial corporations sector surpasses the value of capital services (consumption of fixed capital plus the return to capital). This indicates that after the income distribution part of the resource rent is still included in this sector's disposable income and saving. This result shows that the government appropriates part, but not all, of the resource rent;
- Please be aware that the resource rent includes a natural resource depletion element. The SEEA-CF recommends the recording of net national income, net of natural resource depletion,

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<sup>5</sup> <https://www.nrc.nl/nieuws/2018/06/25/gaswinning-groningen-de-staat-wikkelt-af-de-nam-moet-blijven-betalen-a1607856>

i.e. the asset value loss due to its extraction. The depletion adjustments will show up in the income and capital accounts of the economic owner of the natural resource in question. In the case of the Netherlands it does not make sense to only adjust the net government income for the full natural resource depletion. This would lead to an underestimation of the government's net income as part of the natural resource revenues are not included in government income. As illustrated in table 2, 30% of total natural resource depletion must be included in the gross/net adjustment of disposable income of the non-financial corporations sector. This accounting underscores the presence of shared economic ownership.

**Table 2**  
**A sector accounts presentation of the resource rent allocation in the Netherlands,**  
**2017 (in mln €)**

2017 (in mln €)					
		Non-financial corporations (S.11)		Government (S.13)	
Production					
Output		11232			
Intermediate consumption	4243				
Compensation of employees	769				
Capital services	2579				
Resource rent	3641				
	11232	11232		0	0
Allocation of primary income					
Gross operating surplus		6220			
Dividends (currently classified as rent)	1456				1456
Rent	1202				1202
Balance of primare income (gross)	3562			2658	
	6220	6220		2658	2658
Distribution of income					
Primary income		3562			2658
Taxes	218				218
Disposable income (gross )	3344			2876	
Consumption of fixed capital	2182				
Natural resource depletion*	619			1672	
Disposable income (net )	543			1204	
	3562	3562		2876	2876

\*Unfortunately at present the Dutch environmental accounts do not publish a natural resource depletion adjusted income. The depletion element in this table is approximated by subtracting from the resource rent a return to natural asset income of 3% of the natural gas asset value in 2017 (the average of the opening and closing stock).

Our personal conclusion, not necessarily that of Statistics Netherlands, is that given this assessment of risks and awards, and having a strong preference for compiling environmental-economic accounts in a meaningful way, there is a strong case to assign economic ownership of the natural gas resources in the Netherlands partly to the government and party tot the non-financial corporations, i.e. the NAM. The Dutch situation may be comparable to other countries such as Canada.

### **3. A retrospective view on the precision of NPV estimates**

Capital measurement is inherently a forward looking notion. An asset's value must be assessed on the basis of its expected future earnings, or the future stream of expected capital services. In this respect natural resources are not unique. Also the assessment of fixed asset values and consumption of fixed capital is forward looking in the sense that both depend on future events.

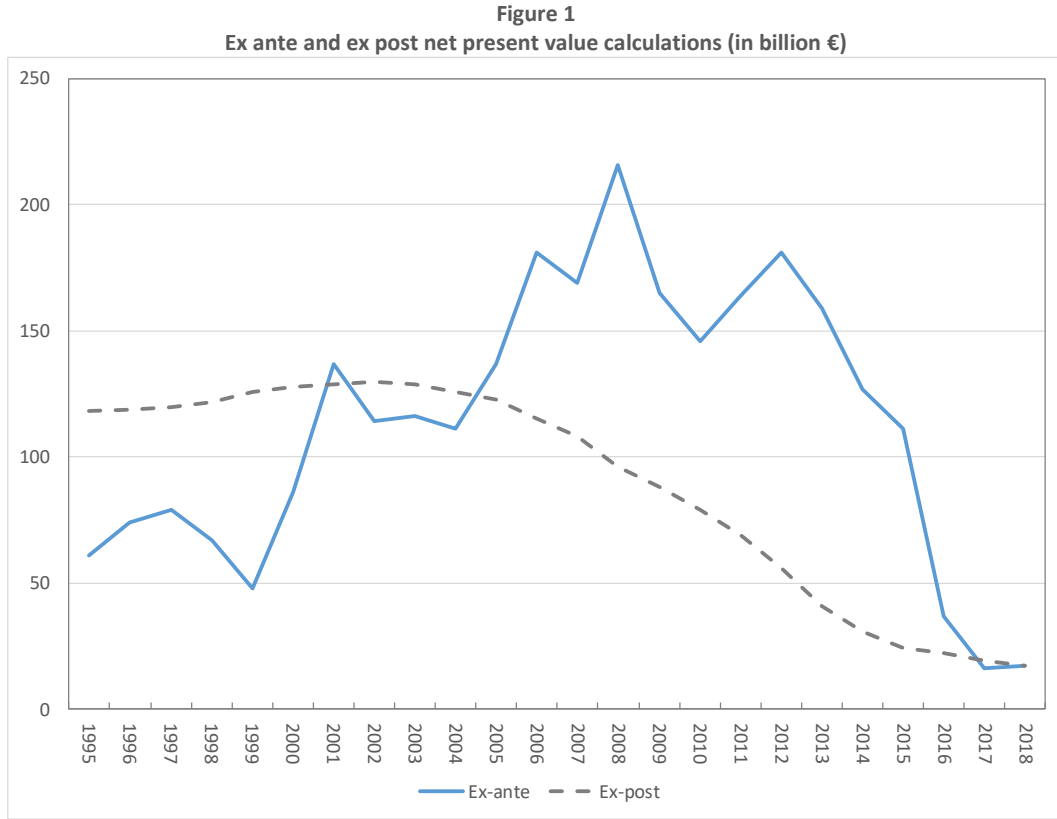
Annex A5.1 of the SEEA-CF 2012 clearly explains that without the availability of well-established market prices for transacted natural resource assets the net present value calculation method is recommended for assessing the asset values of natural resources. These calculations must rely on predicted future unit resource rents and resource extraction levels. In the case of unexpected events, these predictions may turn out to substantially differ from ex-post observed realizations. For example, asset values may decline unexpectedly as a result of rapid technological change or unexpected policy interventions. To illustrate this point, the remarkable Fargo TV comedy introduces a typewriter salesman in the eighties who is begging investors to finance his new shop. At this point in time we fairly well know investing in the typewriters business, on the brink of the arrival of the personal computer, is not a good idea.

As natural gas extraction in Netherlands is coming to an end, we can retrospectively examine the precision of asset value calculations from one year to another. By no means is the intent of these retrospective calculations to replace the officially published asset estimates. What the SEEA-CF explicitly explains (perhaps because it is too obvious) is that values must be assessed on the basis of all information available at the particular time point the asset is being valued. However, when back casting time series, for example after a national accounts benchmark revision, it may be useful to keep in mind the time constraint of information.

The main goal of the ex post calculations is to illustrate that uncertainty about future events may have an enormous effect on resource wealth estimates and changes therein from one year to another.

The uninterrupted (blue) line represents the natural gas asset values as published by Statistics Netherlands in the national balance sheet of the Netherlands. Its volatility is largely due to fluctuations in gas prices from one year to another. The abrupt decline in 2016 is the result of a substantive fall in the gas prices in that year. In the subsequent year (2017), the government decided to substantively diminish extractions and to totally phase out extraction in the Groningen gas field by 2030.





The ex-ante calculations, as published by Statistics Netherlands, can be summarized as follows:

$$AV_{t=0}^{ea} = \sum_{t=1}^n \left( \frac{RR_t^e (\Delta p_{rr,0 \rightarrow t}^e)}{(1+i)^t (\Delta P_{cpi,0 \rightarrow t}^e)} \right)$$

The ex-ante asset value ( $AV$ ) is estimated as the net present value of expected future resource rents ( $RR$ ).  $AV^{ea}$  also needs to rely on assumptions on price developments such as the expected resource rent price change  $\Delta p_{rr,0 \rightarrow t}^e$  within the time interval  $\{0 \rightarrow t\}$ . Further, the nominal interest rate exists of a real interest rate  $i$  and a general price inflation component  $\Delta P_{cpi,0 \rightarrow t}^e$ . Calculations for the Dutch asset values for natural resources are simplified by assuming that

$$\Delta p_{rr,0 \rightarrow t}^e \approx \Delta P_{cpi,0 \rightarrow t}^e$$

In wording, the expected price development of the resource rent equals by and large the expected price inflation. This assumption results in a very simply ex-ante NPV calculation:

$$AV_{t=0}^{ea} = \sum_{t=1}^n \left( \frac{RR_t^e}{(1+i)^t} \right)$$

However, the consequence of this assumption is that changes in resource prices from one year to another are directly translated to asset value holding gains, which make the asset values equally volatile as current resource prices.

The ex-post calculations, represented by the grey interrupted graph, are based on ‘cheating’ in the sense that at this point in time we have obtained most of the evidence on how gas resources in the

Netherlands were extracted and cashed. Only a tiny series (in quantities and length) of extractions still lies ahead of us. The ex-post calculations are done as follows:

$$AV_{t=0}^{ep} = \sum_{t=1}^n \left( \frac{RR_t}{(1+i)^t (\Delta P_{cpi,0 \rightarrow t})} \right)$$

Superscript *ep* indicates the ex-post calculation of asset values. On the right-hand side superscript *e* is not present as the variables represent actual observations instead of expectations.

One obvious result of the ex-post calculation is the dampening of asset price fluctuations from one year to another. In the ex-post calculation the volatility in gas prices have a much smaller effect on the year-to-year changes in asset values. In the past, the asset values of gas resources as officially published by Statistics Netherlands were based on three-year moving averages of unit resource rents (Veldhuizen et al, 2009). In the course of the 2010 benchmark/ESA 2010 revision, the use of moving averages was conceived as being inconsistent with the SEEA-CF 2012 as the unit resource rent value of extraction appeared to be inconsistent with the in situ unit resource rent based on the three year averages. Also delays of the effects of recent developments in resource prices was considered an undesirable consequence. From 2014 onwards, moving averages were no longer applied in the natural resource accounts of the Netherlands.

However, the ex-post calculations indicate unit resource rent for the year *t* are not necessarily a reasonable proxy for the unit resource rents in upcoming years  $\{t+1, t+2, \dots, t+n\}$ . This is also emphasized in the OECD (2018) publication on compiling mineral and energy resource accounts. Perhaps somewhat ironically and despite the perceived inconsistencies found by the colleagues from Statistics Netherlands, the SEEA-CF 2012 (5.199) also recommends using smoothing techniques of unit resource prices, such as moving averages for arriving at more realistic asset values.

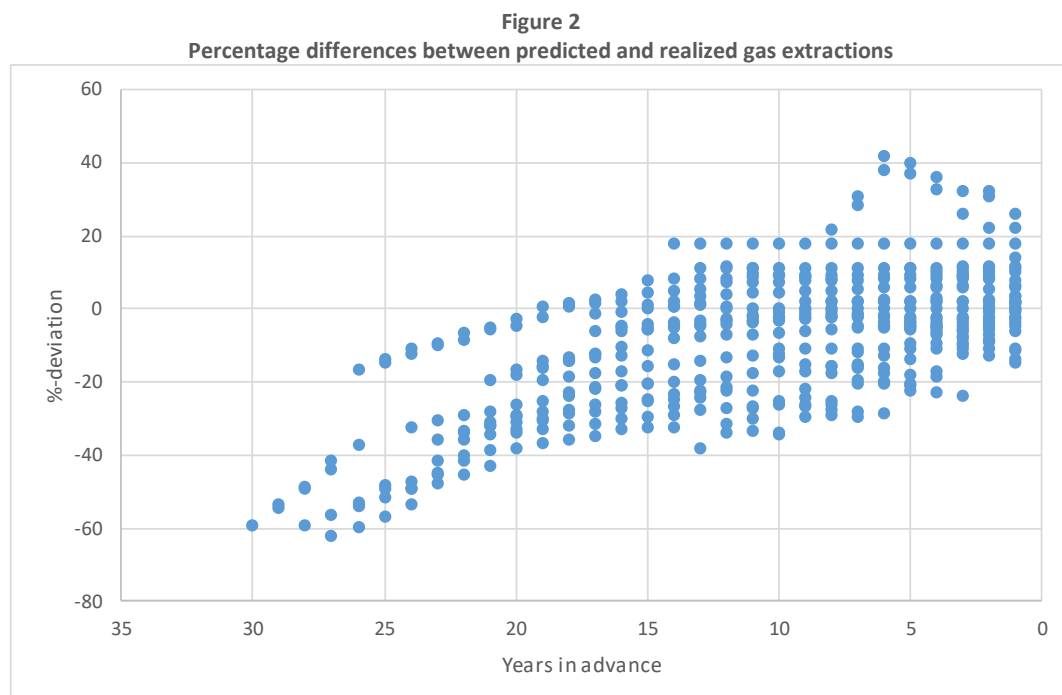
The ex-post calculations in this paper confirm the importance of eliminating resource price volatility but also show that particularly the asset values reported after 2004 have been heavily overstated. The extremely high energy prices encountered at that point in time appeared to resemble highly overstated predictions of the subsequent years' unit resource prices.

Perhaps a counterintuitive outcome of the ex-post calculations is the slight rise in asset values found in the period 1995-2002. Please be aware that the ex-post asset values are not in any way influenced by resource reappraisals. It appears that in this time period the positive effect of unwinding of the discount rate from one year to another overcompensated the annual value losses due to natural resource depletion. This leads to the paradox that, despite being depleted, a non-renewable natural resource may *ceteris paribus* increase in value, making its owner still better off at the end of the year in terms of net worth.

Another aspect of the ex-post evaluation of net present value calculations is the precision of future extraction forecasts. Statistics Netherlands uses net present value extraction scenario's as set by the Ministry of Economic Affairs. These scenario's rely on information on future extraction plans as obtained from mining corporations policy thresholds particularly applying to the Groningen gas field. Figure 2 provides an overview of the percentage differences between predicted and realized annual gas extractions. The horizontal axis identifies the years in advance a prediction was made. Of course

the obvious conclusion is that predictions 20 to 30 years ahead are less reliable than shorter-term predictions. A less obvious result is that the long term predictions are on average understated. It should be noticed that, due to the discount factor, long term prediction errors have a weaker impact on asset value estimates than the shorter term errors. The results in Figure 2 also show that, at least in the case of the Netherlands, future extractions are generally difficult to predict, even one year in advance. Possibly part of this has to do with weather conditions. Cold winters will lead to larger gas extractions for the heating of homes. Within one extraction scenario, these incidental weather effects may partly phase out, making the net present calculations less vulnerable to this uncertainty.

At least conceptually, an amplifying interaction between unexpected service life changes and future unit resource estimates may occur. For example as a consequence of an abrupt policy imposed restriction of the (socially allowable) extraction period of a natural resource, fixed capital assets (i.e. rigs and other equipment) must be depreciated within a shorter time span. This directly increases the capital costs of extraction and generates a downward adjustment of the unit resource rent. So the downward adjusted service life and a lower unit resource rent will both diminish the natural resource's asset value.



#### 4. The problems in Groningen

Not very long ago the gas fields in Groningen were considered a blessing, even though in the sixties and seventies it became apparent that natural resource wealth would not automatically bring economic prosperity, a phenomenon later on explained by Neary & Gordon (1982) as the Dutch disease. Nowadays the Groningen situation is by some referred to as a disaster because of the social disruption caused by the earthquakes. Inhabitants suffer from fear, are uncertain about damage compensations and are facing long delays in compensation payments.

A full assessment of the (expected) damages and required compensation payments is probably difficult to make. A letter of the Minister of Economic Affairs and Climate Policy to the Dutch Parliament (16 January 2018) mentions the total damage (e.g. reconstruction of dwellings and buildings, value losses of real estate, psychical damage) could be as much as €10 billion. Although at first sight this seems a considerable sum of money, as a percentage of cumulated resource rents the expected compensation costs are actually quite low ( $\approx 0.5\%$ ). The point is of course that the state and the NAM have, until recently, not been accumulating parts of their gas revenues for the sake of future compensation payments. If they had done so, the costs could have been covered without blinking an eye.

This brings us to the question of how compensation costs should be recorded in the environmental and national accounts. The quick and easy answer provided by the international standards (SNA 2008, ESA 2010), is that these payments are to be classified as ‘other capital transfers’ (D.99). Par. 10.212 (a) of the SNA 2008 gives the following guidance: *“Major payments in compensation for extensive damages or serious injuries not covered by insurance companies. (..) They include payments of compensation for damages caused by major explosions, oil spillages, the side effects of drugs, etc”*.

In the case of Groningen the size of the expected compensation costs are perhaps within the error margin of the estimated (cumulated) resource rents. But perhaps in the near future other cases may arise where the expected compensation payments are more significant relative to resource earnings. For example, there is some concern about the possible negative consequences of hydraulic fracturing (fracking) on human health and ecosystems, but also with respect to seismic activity this gas extraction method may bring about. In other words, it is not unlikely the mining corporations applying fracking will at some point in time be held accountable for resulting damages.

A crucial point is that resource rent calculations are overstated once the costs of expected compensation payments are not taken into account. In that respect there is an analogy with the treatment of decommissioning or terminal costs in the SNA. Par. 10.51 indicates that *“any terminal costs incurred at the end of an asset’s life such as those required to render the structure safe or to restore the environment in which it is situated”* should be part of gross capital formation. One of the merits of this recording is to create in the accounts the possibility to charge the terminal costs against the series of resources rents in the form of a production cost, i.e. consumption of fixed capital. This recording is not only required for a proper calculation of resource rents but also for properly estimating natural resource asset values.

**Table 3**  
**The analogy of termination and compensation costs**

	Mining Industry		Mining Industry		Households
Terminal costs:	CFC	→	GFCF		
Compensation costs:	Provision charge	→	Pay off the provision	→	GFCF

The analogy of compensation and terminal costs are summarized in table 3. Both will eventually lead to expenditure with the purpose of compensating for the unwanted side-effects of mining. Most of this expenditure will probably be in the form of gross fixed capital formation (GFCF) i.e. the repair of dwellings. With respect to termination costs, the SNA 2008 already allows for recording consumption of fixed capital in advance of GFCF. The suggested provision charge (not an SEEA/SNA concept at this moment) has a similar purpose, namely a cost charge to meet future obligations. In the case of terminal costs the obligation is a GFCF needed to clean up the equipment and restoring the environment after termination of the mining operation. The provision allows households, or any other party, to restore damages on their property. In other words, a transfer of resources is needed before the GFCF can take place.

When it becomes clear the natural resource owner/extractor will be held responsible for compensation payments, one may argue that related costs must be recorded in the production account, in a similar way as the writing-off in advance of future decommissioning investments. In other words, resource rents will be overstated when future compensation payment obligations remain unrecorded as a cost of production.

This issue coincides closely with the recognition of provisions in corporate accounting (cf. IAS 37). As already mentioned, in recent years the NAM started with holding provisions for the consequences of gas mining induced earthquakes. Provisions are currently not recorded in the SEEA/SNA. The SNA 2008 refers to provisions in its the research agenda (Annex 4) but the SEEA-CF research agenda at present does not. IAS 37 defines a provision as a liability of uncertain timing or amount. A provision should be recognized under the condition that:

- a present (legal) obligation has arisen as a result of a past event;
- payment is probable;
- the amount can be estimated reliably.

Future obligations with respect of compensating environmental damages (land contamination, clean-up offshore operations including restoring sea beds) are mentioned as one of the examples of provisions. An important measurement issue is whether or not the provision refers to a one-off settlement or to provisions for large populations which are spread over a longer period of time (e.g. the Groningen case). In the latter situation, the total sum is obviously much harder to assess. But this does not diminish the likelihood of future compensation payments.

A provision seems to bear the characteristics of a financial asset or claim as it represents the right of a creditor to receive a payment from a debtor. The introduction of provisions in the environmental/national accounts implies that the recording of the settlement of obligations will take place in the financial accounts and not in the capital account. The recording of provisions replaces the recording of an 'other capital transfer' in the current international standards.

Table 4 is a fictive example of a suggested recording of provisions, or a so-called *provision charge*, in the production account of a future version of the SEEA-CF. The entries colored in red represent new or modified concepts compared to the current SEEA-CF 2012. According to the SEEA (and the SNA) the resource rent is to be determined in the production account of the mining company by subtracting

from output (the market value of extracted minerals) the costs of production. The hypothetical case presented in table 4 illustrates how these costs are extended to also include a provision charge representing a part of the current generated income that must be reserved for future compensation payments. The amount of 85 is the result of an expected compensation payment of a 1000 after termination of a mining operation with a service life of 10 years. A series of annual payments of 85 should in ten years' time, together with accumulated interest, be sufficient to meet this future obligation.

**Table 4**  
**A fictive presentation of a SEEA production account**  
**including a provision charge element**

		Non-financial corporations (S.11)
<b>Production account</b>		
Output		1000
Intermediate consumption	400	
Compensation of employees	100	
Capital services	100	
Provision charge	85	
Resource rent ( <i>balancing item</i> )	315	
	1000	1000
<b>Gross/net operating surplus</b>		
Gross operating surplus		500
Consumption of fixed capital	80	
Resource depletion	205	
Provision charge	85	
Net Operating Surplus ( <i>balancing item</i> )	130	
	500	500

The table indicates the resource rent must be recorded net of the provision charge. The table also suggests to exclude in the SEEA, in addition to consumption of fixed capital and resource depletion, also the provision charge from net operating surplus, income and savings. So, the underlying definitions of the resource rent and net operating surplus as presented in the table differs from those found in the current SEEA-CF 2012.

The case of the Netherlands shows that the need for compensation costs may become apparent halfway through the service life of a mining business. This has consequences for determining the provision charge for the remainder of the expected service life of the mining operation. Its size should probably be set as if the costs of provisions were distributed over the entire service life. At the same time it does not make sense to retrospectively adjust previous resource rent calculations in the period before the damage to other parties manifested itself. This time allocation issue probably requires further thinking.

## 5. Conclusions and recommendations for future work

Even though gas extraction in the Netherlands has not yet come to a full end, this paper looks back at the experiences obtained at Statistics Netherlands from natural resource accounting for gas. This review leads to the following conclusions and suggestions for future work:

- Factoryless (or rigless) producers may also be found in the mining industry. An upcoming decision on the classification of FGPs should also address the economic classification of rigless producers inside the mining industry;
- The next revision of the SEEA-CF should further elaborate on the possibility of assigning economic ownership of natural resource assets to more than one single economic owner. Based on the analysis risks and rewards the case of the Netherlands seems to provide evidence for the occurrence of a shared economic ownership between the state and private gas extractors. Anyway, additional guidance in the SEEA-CF on how to construct natural resource accounts on a sector-by-sector basis would be more than welcome, particularly for compiling full-fledged balance sheets for the state;
- A next version of the SEEA-CF could further elaborate on the extent to which taxes on income, in particular corporate taxes payable by mining companies, interact with resource rent calculations. Supplementary corporate taxes specifically levied on mining companies probably fall within the scope of the resource rent. For corporate taxes payable under generic tax regimes the situation is less obvious. As mentioned the SNA does not recommend capitalizing future tax earnings in the government balance sheet. Implicitly the current SEEA-CF methodology seems to move in this direction;
- The case of the Netherlands shows that natural resource accounting in money terms is inherently subject to a high degree of uncertainty. The international accounting standards should emphasize better that, generally, capital measurement is a forward looking concept. It requires statisticians to predict the future use of assets they want to give a price tag. With respect to natural resource accounting the volatility of mineral prices makes things worse. There seems to be some similarity with the pricing of natural resources and the stock prices of companies. Both fully depend on expectations on future profits. For both prices developments in time tend to be highly volatile. Perhaps advanced smoothing techniques may help to eliminate the largest price fluctuations in the unit resource rents which used to price the future extractions. Another part of the solution is probably carefully communicating the results of natural resource accounting to users. As earlier indicated by (former) colleagues at Statistics Netherlands, the smoothing of unit resource prices may lead to consistency issues in the natural resource accounts in which the annual extractions are being valued at current (unsmoothed) unit resource rents. This may be an issue for future research or perhaps clarification. The SEEA-CF 2012 (A5.1) explains quite well that also the depletion element should be valued at the average in-situ unit resource rent (whether based on smoothing or not).
- Finally, this paper discusses the issue of provisions in the context of natural resource accounting. Natural resource extraction may not only lead to resource depletion but also to

other environmental damages or damages to fixed assets and human health. At present the international environmental-economic standards provide guidance on how to record terminal or clean-up costs. This paper argues that the costs of compensation payments should be treated in a similar way. This is why the issue of (provisions for) compensation payments should be placed on the SEEA-CF research agenda.

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