The energy sector in Scotland’s future

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1. Introduction

In thinking about the role of the energy sector in an independent Scotland it is essential to put aside preconceptions based on the current situation in which Scotland is part of the much larger economic unit that comprises the United Kingdom. As a separate country, Scotland will be a classic small, open, resource-dependent country but with a rather poor location. The last qualification matters because the rents that can be earned from its natural resources – not just energy but agriculture, tourism and other resource-based activities - are affected by its location and may be lower than would be the case for other European countries.

The consequences of the country’s new status will extend far beyond the design of policies for the energy sector. As other countries in a similar position have learned, macroeconomic and monetary policies have to be designed to accommodate and adjust to the economic shocks that are associated with the volatility of international markets in energy and other natural resources. At the moment the impact of such shocks is largely borne by economic stabilisers within the UK, particularly via a variety of budgetary transfers together with labour mobility and inter-regional trade flows.

In this paper I will argue that the importance of the energy sector in the Scottish economy is not consistent with the “independence-lite” view of constitutional change. In particular, it is very doubtful that it would be sensible for an independent Scotland to commit itself to a fixed exchange rate with either the pound sterling or the euro. Indeed, a fixed exchange with the euro would almost certainly lead to a disaster within two or three decades, unless it was accompanied by an effective economic union within the Euro-zone in which control over the management of the Scottish economy is largely ceded to central institutions.

The central issue for Scottish economic policy after independence will be: how should we manage a highly capital-intensive and rather volatile sector that accounts for a significant share of GDP and an even larger share of tax revenues? One answer is to follow the example of Norway and to use a sovereign wealth fund to separate domestic economic management from international energy markets. However, even in Norway this strategy has been based upon a large element of luck in timing and most would-be imitators have not been as successful. The Norwegian model relies heavily on public control of the main oil & gas producer – a model that has major disadvantages in most of its variants and is almost certainly not feasible for an independent Scottish government.

Major constitutional change is driven by many considerations, most of them with little or no connection to the state of the economy or international markets. An outsider might observe that economic circumstances in 2013 are far from ideal timing for independence, given the current state of energy markets and fiscal conditions. The optimistic view is that everything will turn out well

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1 The views expressed in this paper are strictly personal and do not reflect the official position of any institution with which I am associated.
because international energy prices will increase significantly in real terms over the next one or two decades. That is happened from 2003 to 2013, but it is important to remember that there was a severe downturn in real prices during that period which would have caused a huge shock to the Scottish economy had the country been independent. Future policy cannot be predicated on the assumption that rapid economic growth in China or India will underpin the world energy market for the next 20 years.

Finally, the analysis presented in this paper is not intended to make a case for or against constitutional change. As many other economists have noted, the view that there might a decisive economic case for making such a choice is one held by non-economists and not by most economists who have thought about the economic arguments carefully. My goal in writing this paper is to identify and examine the economic issues arising from the role of energy in the Scottish economy that would have to be addressed if Scotland chooses the path of independence.

2. The size and characteristics of the energy sector in Scotland

The energy sector is highly capital-intensive, not only for direct production but in the infrastructure required to support it. A large share of the revenue generated by the sector is committed to the return on and the recovery of the capital invested. Further, oil and gas production requires continuous investment to maintain production. As a mature province, the marginal investment that is required to sustain and/or increase oil & gas production in Scotland is considerably higher than in many other parts of the world. This cost may be offset by lower risks, but only if the investment climate is favourable.

[To be extended]

3. Energy prices and economic management

Real energy prices are prone to large cycles over the medium term. Currently they are high but it would be unwise to assume that the cycles in energy prices will be less important in future. Many of the UK’s current energy policies are predicated on the assumption that the real price of energy, particularly of gas, will steadily increase over the next 5 to 10 years. Those projections underpin the Scottish Government’s assumptions about the rents that may be earned from oil and gas production in Scotland is considerably higher than in many other parts of the world. This cost may be offset by lower risks, but only if the investment climate is favourable.

The story of “fracking” – the deployment of new technologies to extract reserves of oil and gas that were previously inaccessible – provides an illuminating example of the potential benefits and risks for Scotland in relying upon rents from energy production. Despite the rather overheated debate in the UK, fracking is neither a particularly novel technology nor is necessarily the key to unforeseen riches. As a technology it has been gradually developed and deployed over a period of 30-40 years. It is an illustration of the rapid technical progress that has characterised the oil and gas sector since the 1950s. The adoption of this technical progress is largely driven by real energy prices because it tends to require huge investments in long-lived assets.
Oil and gas resources are not especially scarce. What matters is not the availability of physical reserves but the economics of extracting and getting the energy to market. This is particularly important for gas, which is abundant in many parts of the world but which is expensive to transport. The economics of gas production in the past has revolved around the development of pipeline networks. In the last two decades the technology with the greatest impact on the world gas market has been the production and transport of liquefied natural gas (LNG). The scale and expense of the assets required to handle LNG has favoured the development of centralised facilities based upon supply from large gas reserves. In turn, this centralisation has caused severe problems of cost inflation and skill shortages which have delayed the exploitation of new resources and increased the market price at which development can be justified. The production of oil from tar sands in Canada has gone through an identical cycle.

Fracking is a different response to the same market incentives. Reserves of shale gas are widely spread but the reservoirs are not large. The combination of horizontal drilling and fracturing reservoir walls allows producers to extract gas or oil from dispersed, small or medium reservoirs. It relies upon the existence of an extensive pipeline network to collect gas or oil from dispersed production sites and transport it to centres of demand or refining. The nature of the pipeline system in the US is a critical factor why fracking has developed so much more rapidly in the US than in other parts of the world. The factors which have underpinned the rapid growth of fracking are not restricted to shale gas. The same considerations apply to the extraction of gas from coal reserves - coal-bed methane – which is already important in Australia and is likely to be attractive in many other countries with large coal resources.

For Scotland it is necessary to separate two strands in the debate about the impact of shale gas on the gas market and energy prices. Like a number of other countries, the UK has abundant reserves of shale gas and coal-bed methane. Whether or not these are exploited is a matter of how the rents from and the costs of extraction are distributed. It seems unlikely that the potential income will be given up, but there are examples in the energy sector of other countries where this has happened.

However, any decision that is made in the UK is irrelevant in the context of global energy markets and environmental concerns. It is a certainty that the extraction and use of shale oil and gas, coal bed methane and other unconventional reserves of oil and gas will expand rapidly as long as the real prices of hydrocarbons remain high. China, in particular, could increase its use of gas from 2% of primary energy use in 2008 to more than 20% in 2030 – IEA (2012), ADB (2013). This will not happen if the country has to rely on imported gas because it recognises the impact of large imports on international markets, especially in the Asia-Pacific region. Instead, it is likely to develop its abundant reserves of shale gas while also making large investments in nuclear power as a backstop.

This approach illustrates why the assumption that the real prices of oil and gas in international markets will continue to increase is unlikely to be correct. Demand shocks – especially rapid growth in China and the response to the Fukushima accident in Japan – have pushed up gas prices in the Asia-Pacific market, whereas an increase in production based upon technical innovation has lowered gas prices in North America. This situation will persist only as long as the markets are segmented by lack of transport capacity. However, the investments in developing new reserves and transport facilities that are already under way will increase market integration and put downward pressure on both oil and gas prices.
The medium and longer term prospects for oil and gas prices depend upon the balance between three factors: (a) growth in demand, (b) investment in massive resource developments such as offshore oil in Brazil and Africa or LNG projects in East Africa and Australia, and (c) technical innovation focused on small to medium scale development and enhanced recovery from existing fields. The storing of fracking in the US shows how the third of these factors, driven by the incentives provided by high prices, can have a very large and rapid impact on prices in a market where the right conditions exist.

The position of the UK government is that demand growth will consistently trump developments on the supply side, so that the cyclical pattern associated with the slow response of supply to higher prices will not re-establish itself. Still, projections based on the assertion that “this time everything is different” ought to regarded with a considerable degree of scepticism and do not provide a secure foundation for assessing Scotland’s future macroeconomic and fiscal position.

4. The resource curse and economic management

Every country in Scotland’s position – even Norway – has suffered from some degree of Dutch disease caused by the volatility of the energy market. The usual pattern is that high prices and returns generate an investment boom which drives up wages and the costs of non-traded sectors – construction, services, etc. This undermines the viability of non-energy manufacturing activities which close down or relocate. While Scotland remains part of the UK this effect is diffused over a much larger economy, but it would be acute when concentrated in Scotland. When the downturn occurs, as inevitably it will, the boom is replaced by higher unemployment and a severe squeeze on the public finances.

The classic remedies for this kind of energy-driven economic cycle are (a) allow the exchange rate to move in a counter-cyclical manner, (b) encourage factor mobility – in practice the out-migration of workers, and/or (c) build up a large stabilisation fund. Almost certainly all of these policies would be required but it is not clear that the Scottish Government or the population understands the implications.

Given the experience of the UK, Norway and many other resource-dependent economies, the debate over monetary policy and exchange rates if Scotland were to become independent is extremely odd. If the Euro crisis has taught anyone anything, it should be that the costs of maintaining a fixed exchange rate between economies subject to disparate and uncorrelated shocks are extreme unless these are diffused by some form of economic union with fiscal transfers. The classic monetary trilemma can be re-expressed in this context as: either Scotland can be independent or it can operate a fixed exchange rate but it can’t have both at the same time. That is ultimately the reason why Norway has not joined the Euro-zone and should not in future.

This poses an awkward problem of reconciling political considerations with economic experience and logic. A part of the case for Scottish independence rests on the belief that Scotland will and should remain within the European Union after separation from the UK. However, it is a fundamental principle of the EU that new members should follow a path to become members of the Euro-zone within the foreseeable future. If Scotland’s continued independence is contingent on not making a commitment to enter a fixed exchange rate regime, then this will require a large degree of flexibility on both sides.
The situation would, if anything, be worse, if Scotland wanted to retain a fixed exchange rate with the rest of the UK. There are cases in which countries have either adopted another currency – e.g. dollarization in Ecuador or Zimbabwe or have successfully implemented currency board mechanisms that tie their currency to a fixed exchange rate with a dominant currency, but the number of cases in which such attempts have failed is much greater than those where it was successful. Outsiders are likely to take the view that Scotland is more similar to Argentina than to Hong Kong, even without the shocks brought about its dependence on volatile energy markets.

A fixed exchange rate means that the burden of adjusting to external shocks from the energy market must fall on factor incomes, either through changes in real incomes or by factor mobility. A sovereign wealth fund, discussed in the next section, is primarily a mechanism by which countercyclical savings and capital flows can be managed, so it falls in the general category of factor mobility.

The importance of labour mobility is easily seen in thinly populated regions that experience an energy boom. The rapid development of trailer parks and stacks of portakabins to house transient workers are not just a journalistic trope but the reality of daily life in North Dakota, Alberta and Western Australia as a response to huge investments in developing and exploiting energy resources such as shale oil, tar sands and offshore gas. The mobility of such workers is critical in the process by which such regions respond to market cycles. In contrast, Scotland's workers are notably immobile, while its social arrangements and infrastructure have not adapted to cyclical upswings or downswings in demand for labour and skills. Even during boom periods, the offshore oil & gas industry relied heavily upon workers who commuted from other parts of the UK or Europe.

It is conceivable that the Scottish labour market could evolve in the direction of much greater flexibility after independence. Scotland might become more like Ireland with relatively largely inflows or outflows of labour driven by changes in cyclical conditions. Indeed, this may be viewed as a reversion to the pattern which prevailed more than a century ago. This is not an aspect of the comparison between the two countries which advocates of independence have chosen to highlight. The social effects of high levels of migration have generally been thought to be undesirable in both countries. Hence, it is likely that there would be considerable resistance to the idea that economic management would have rely upon a large increase in labour mobility.

5. **Stabilisation via a sovereign wealth fund?**

Advocates of independence and other commentators accept the principle that an independent Scotland should attempt to stabilise its economy by relying upon capital flows via a sovereign wealth fund (SWF), again following the example of Norway. There is less agreement on the details, other than a lament that this should have been done in the past.

That argument is based on a misunderstanding, at least when viewed from the perspective of the UK as a whole. The key behind a SWF is that natural capital, in the form of oil or other depletable resources, is converted into physical and financial capital using the SWF as a vehicle for holding the ownership of the capital. But this is not the only way by which such a transfer can be achieved. As an alternative, natural capital is often converted into human capital by using some or all of the rents that are earned to fund public expenditures on education, health or R&D. A similar outcome can be achieved via public investment in physical infrastructure.
There is a literature on what some economists refer to as “genuine savings” by which national accountants attempt to estimate whether the depletion of natural capital is offset by the accumulation of other kinds of capital – see Hamilton (). There is no general reason to presume that a SWF is necessary to ensure that the rents from depletable resources are reinvested in other productive assets when considering large, diversified economies. The situation of small resource-dependent economies is rather different. The reason is that such countries may need to export capital if they are to deploy their savings to earn a reasonable return. A SWF is, thus, a mechanism for organising the export of capital that is owned collectively.

A simple numerical example will illustrate the point. Consider two developed countries – country A which is small and has resource rents amounting to 20% of GDP and country B with rents amounting to 2% of GDP. If the saving rate out of other factor income is 18% - typical of OECD countries after allowing for the accumulation of human capital - then country A would have total savings of 34.4% of GDP if it were to reinvest all of its resource rents while the equivalent figure would be 19.6% of GDP for country B. Country B should have no difficulty in investing an additional 1.6% of GDP in its human capital or physical infrastructure without have a significant impact on the returns to investment. In contrast, an increase in domestic investment from 18% to 34.4% of GDP is likely to drive down the marginal return on investment quite substantially. Investing outside the country via a SWF is thus essential, since the alternative is that resource rents will be largely consumed rather than reinvested.

Using this illustration it is possible to understand how Norway has made use of its resource rents and the role played by its SWF. A large part of the rents generated by the oil and gas sector in Norway has been ploughed back into investment in the same sector. This managed through companies, primarily Statoil and (in the past) Norsk Hydro, which are wholly or partly state-owned. Another part of the resource rents have been allocated to public expenditures on human capital and infrastructure designed to enhance skills, fund R&D and provide long-lived assets that raise real incomes and the general return on capital in Norway. Money allocated to the SWF is, thus, a residual that has been accumulated after funding investment in domestic assets.

Norway’s SWF is very large with a value that is nearly 1.5 times GDP at the end of 2012. This is a reflection of the huge scale of the resource rents that have been earned by Norway from oil and gas over the last three decades. Still, it should be remembered that significant oil production in the Norwegian sector started with the Ekofisk field from 1975 while the SWF was only established in 1990. Since the SWF is required to invest outside Norway and is, in effect, the residual recipient of the resources after sector investment and domestic tax requirements are met, it provides a mechanism by which variable flows of surplus capital can be exported and drawn upon if the level of rents should fall substantially in future as a result of depletion or market volatility.

Proposals for a Scottish Oil Fund are quite different. The starting point is much worse than it was in Norway. The Scottish Government is committed to levels of public expenditure which can only be financed if tax revenues, which account for the bulk of resource rents, are used to underwrite consumption rather than investment. Even starting to contribute to an Oil Fund will require a major fiscal adjustment including some combination of lower public spending (as a share of GDP) and higher taxes. The Scottish Government does not control assets in the Scottish sector and cannot reduce the share of resource rents going to private investors without jeopardising future investment and, thus, future rents.
As I have argued, the real level of oil & gas prices is high by comparison with historic levels and reasonable expectations for the future. Thus, if an Oil Fund were to be used for economic stabilisation the implication is that the Scottish Government should be make large contributions to the Fund now, which would be drawn down at some later point in the cycle. Of course, this does not mesh easily with the argument that public expenditure needs to be boosted – or at least sustained – to provide a macroeconomic stimulus. The lesson is that using resource rents to finance macroeconomic policies may be difficult to reconcile with a proper long run strategy for managing the depletion of natural capital and its transformation into human and physical capital. In this respect, the UK government has consistently failed to shift away from a very short term view of economic management and the Scottish Government has no clear vision of how that transition might be achieved.

6. Financing investment in the energy sector

The production of oil and gas – and renewable energy as well – are not merely capital-intensive but require a continuing flow of reinvestment in both exploration for and development of new reserves if production and resource rents are to be maintained. Too many countries around the world – Mexico, Indonesia, the former Soviet Union – have made the mistake of believing that they could consume that resource rents generated by early and often very large discoveries. There are very few countries whose endowment is so large that they do not have to reinvest a significant portion of their cash flow from oil and gas in the sector – and Scotland is certainly not one of them. In addition, a commitment has been made to spend large sums on decommissioning North Sea infrastructure when fields are taken out of production.

Since the most of the past rents from the oil and gas sector have distributed to investors or used to finance government consumption, Scotland must rely upon attracting new finance to extend the life of existing reserves or to develop new reserves. As a consequence it must offer a financial and fiscal regime that is sufficiently attractive to ensure the capital inflows that are required, since the level of investment that can be financed from domestic savings falls far short of what is needed.

As an illustration consider the case of renewable energy over the period up to 2020. Scotland’s share of total investment in wind power plus associated infrastructure is likely to be of the order of £50 billion. On the other side of the account, Scotland’s share of total business investment in the UK is about £15 billion per year or £90 billion in the years 2014-19. In other words, investment in wind generation alone will account for more than 50% of total business investment in Scotland over a period of 6 years. The share is even larger from 2020 onwards. Add investment in oil & gas production as well as decommissioning and the energy sector will absorb all of the resources available for business investment in Scotland.

The usual response is that Scotland would be attractive to external investors as a developed country with stable institutions and an attractive fiscal regime. In the long run, that view may be shared by outsiders. Nonetheless, for at least 5 and perhaps 10 years after separation the uncertainties about how market arrangements between Scotland and the rest of the UK will develop are likely to mean that a risk premium will be included in setting the hurdle rate applied when assessing energy projects in Scotland.
In any case, the UK's existing fiscal regime for oil and gas production has certainly not been stable and is not especially attractive. Indeed, the Scottish Government has criticised the UK Government for making repeated and often ill-thought changes to the level and structure of taxes. Such criticisms are justified but they have been driven by short term pressures to raise revenue, especially during periods of high oil prices. Those pressures are likely to get worse rather than better if Scotland became independent and the Scottish Government would have to establish its own reputation for operating a stable fiscal regime.

The larger issue is the extent to which the Scottish Government would rely upon revenue from taxes on business to finance its social programs. The impression is given that Scotland might follow the example of Ireland by opting for a low headline rate of corporation tax, though the Irish system is designed to attract multinational investors rather than to ensure low rates of tax for all businesses. Again, the actual record of the Scottish Government is less good than the claims that are made. In recent years it has tried to raise additional revenue by increasing property taxes on large companies (business rates). Most research shows that a large share of taxes on business property is passed forward to consumers, so this could be regarded as a way of raising revenue from taxes on consumption. Still, it seems unlikely that potential investors will see the matter in that light.

As for any small country that has to rely heavily on capital inflows, the Scottish Government may find that it has to lower its expectations of the revenue that it can raise from taxes on business in order to attract the inflows which will be required to sustain the energy sector. In effect, this means that its share of the resource rents from the sector will decline and it will need to increase taxes on either income or consumption in order to fund existing programmes, even before meeting expectations for additional public spending.

7. **Market access and trade in gas**

The question of market access remains an important unknown. Because of its location, Scotland will depend upon the ability to export large amounts of electricity, gas and even oil to England & Wales (E&W). Without guaranteed market access, the resource rents from the energy sector will be significantly lower. It is argued that there is a strong mutual interest in maintaining integrated markets. That view may be too optimistic: history tells us that when countries break up, then unified energy markets tend to weaken quite rapidly thereafter with strong incentives to replace imports by domestic production.

Would separation of the Scotland from the UK be accompanied by a change in attitudes and policy concerning the development of England’s non-conventional gas resources or greater investment in capacity to import LNG? Both would seem to be minimally prudent steps to a government in London that wished to replace the loss of oil & gas rents and reduce dependence on imported gas.

It is reasonable to assume that official attitudes to the development of shale gas in England would be transformed by Scottish independence. The current story offered by the Department of Energy and Climate Change is that the development of shale gas would be a useful source of income but that it would not have a significant impact on gas prices in the UK. This is patent nonsense. Even with a large amount of pipeline capacity, transport and storage costs for gas are substantial. Part of the reason that domestic gas prices have increased rapidly in the UK over the last decade is that prices have switched from an export parity basis to an import parity basis linked to marginal imports of...
LNG. That would be reversed if the development of shale gas were to convert the British market back to export parity pricing. In turn this would have a large impact on the resource rents earned by conventional gas producers in Scotland and on the potential return on investments in offshore exploration and production.

Current assessments suggest that the potential scale of non-conventional gas reserves – coal bed methane as well as shale gas – in both England and Scotland is extremely large. The major barrier to exploiting these reserves is the division of the resource rents between those living close to or on top of them and the taxpayer. The current system of planning and licensing allocates most of the resource rents to taxpayers via Crown rights over subsoil minerals and provides little incentive for residents and local government in areas of exploitation to tolerate the disturbance associated with development and extraction of the reserves. This division is a source of conflict in many countries around the world and the UK has only maintained its arrangement because most oil and gas production is offshore.

If the Rest of the UK (RUK) were faced with a loss of resource rents from most offshore reserves, it would be perverse in the extreme not to follow the example of other countries by offering a larger share of resource rents to local governments and residents in the localities affected by the production of non-conventional gas and oil. Even if getting to this point is slow and somewhat painful, any rational investor will understand that both proved and possible reserves of non-conventional gas and oil in England will be developed. As a consequence, companies interested in developing onshore and offshore production of gas in Scotland will base their investment decisions on the assumption of a shift from import to export parity pricing in the British market combined with an assessment of the wider impact of shale gas and oil on international prices.

The argument that is often made in Scotland to justify a more optimistic view of future gas prices is that Scottish supplies of gas would be seen as more “secure”, because they come from a friendly neighbour, than alternative sources of supply. The greater security would command a premium in contract prices and hence protect Scottish producers from the full effects of trends in international market prices. A variant of the same argument is made for exports of electricity, a topic that is discussed below.

It is not clear why Scottish supplies would be regarded as more secure than those from Norway, so it is unlikely that Scottish gas would command a premium over Norwegian gas. However, this raises an important issue about pipeline access and pricing. Currently, Norwegian gas is imported into the UK mainly through pipelines to the North-East of Scotland (St Fergus) and the Tyne-Tees area (Easington). Were Scotland to separate from the UK, gas for the E&W market imported into Scotland would incur transit charges to pass through Scotland on top of any E&W access and transmission charges. Since there is a single entity, Gassled, which owns the main pipelines which export Norwegian gas, it would be a simple matter for it to increase capacity on interconnectors and divert gas to Easington – or indeed to Zeebrugge in Belgium - if Scottish transit charges were regarded as being too high.

In contrast, apart from the small Irish market, gas producers in Scotland have very limited alternatives to selling gas into the English market, which is why the difference between import and export parity pricing is so important. With independence it is very likely that the high pressure National Transmission System would be subject to separate regulation and price controls in Scotland.
and E&W. It is inevitable that entry and exit charges would be applied to transfers across the border.

Under the current system of transmission charges the capital and operating costs are recovered from a combination of entry and exit charges which are differentiated by entry point and the region in which gas is taken out of the transmission system. To some extent the charges reflect the average delivery distances that for gas entering or exiting the system. Hence, entry charges are relatively high at St Fergus because the average delivery distance is larger than for, say, gas entering at Bacton in East Anglia, while exit charges are low in Scotland because the average delivery distance is shorter than for gas exiting in the South West. Overall, it is likely that separate charging in Scotland and E&W would increase the average transmission cost paid by producers landing gas in Scotland for sale to customers in both Scotland and E&W.

Gas consumers in Scotland might benefit marginally because the market price in the British market is set at the National Balancing Point, which is a virtual trading point but acquires its liquidity from flows through the Bacton to Zeebrugge interconnector. On netback calculations the split of transmission charges between Scotland and England would reduce the average wholesale price of gas delivered in Scotland but increase it in England.

The central point is that independence is likely to lead to major changes in the way in which the gas market is regulated and operates in both Scotland and E&W. Along with changes in incentives for the development of non-conventional gas reserves the consequence is that Scotland cannot expect to enjoy privileged access to the E&W market. Scottish gas producers will find themselves competing with alternative supplies from countries such as Norway and in circumstances where they have very few alternative export markets. The consequence is that the resource rents and factor incomes generated by gas production are likely to be lower than would have been the case in a unified market.

8. Market access and trade in electricity

The situation is similar but even more extreme in the case of the electricity sector. Scotland is a substantial net exporter of electricity to E&W and this surplus will grow if the Scottish Government’s goals to increase production of renewable energy, largely from wind power, are achieved. The technical characteristics of Scotland’s demand and generation mix are entirely unsuitable for an independent market. In relative terms, Scotland has a large amount of nuclear power and too little gas-fired capacity to match the expected growth in intermittent wind generation.

Because of its climate and latitude the country’s demand profile has particularly large winter peaks with short day length and cold weather combined with a relatively low summer base load since there is almost no requirement for air conditioning. Wind generation tends to be greater in winter than summer but peak demand is often associated with low wind output. This can be smoothed by careful management of hydro resources, but total hydro capacity is not sufficient to offset the intermittency of wind even today and the problem will be much worse in future.

The Scottish Government’s view is that it will be possible to ensure the continuation of an integrated electricity market covering Great Britain and that, in particular, England would wish to import electricity generated from renewable sources in Scotland. On this argument, Scotland’s wind power
and its potential for marine power are valuable resources that will generate substantial resource rents for Scotland.

There are scenarios in which this optimistic prognosis could be correct, but it is wise to consider what the alternative scenarios might look like. The worst outcome is that the GB market splits into separate Scottish and E&W markets with power trading between the markets. Scottish wind producers would lose a significant portion of their revenues under separate markets because of the way in which dispatch and market pool rules operate. Under current rules wind generation is dispatched whenever it is available, i.e. when the wind is blowing. This ensures that they earn the sum of the spot market price plus the value of the Renewable Obligation Certificates (ROCs) allocated for each MWh of generation. Because of this “must run” priority, wind generators are compensated by the System Operator (National Grid) – and, ultimately, by electricity consumers - if transmission or demand constraints mean that available generation cannot be dispatched.

This mechanism will come under pressure as the amount of intermittent generation capacity in the UK market increases and it is entirely unworkable with separate Scottish and E&W markets. The reason is that the System Operator for the E&W market would have no reason to give priority in dispatch to wind generation located in Scotland. Indeed, it could not do so because during periods of low demand in the UK the amount of nuclear capacity in Scotland, which for technical reasons has to be given “must run” priority as well, is close to or may exceed demand in Scotland. Flows of electrons are just that; they do not come with labels as to how they were generated. So, unless an interconnector or transmission line is dedicated to generation from a single source, it is impossible to give priority to certain kinds of generation delivered from one integrated system to another.

The consequence of a break-up of the GB market will be that large amounts of wind capacity located in Scotland will be either (a) constrained not to run or (b) forced to accept much lower – even negative – prices in order to be dispatched. This is a common experience in power markets with an excess of “must run” capacity relative to base load demand – e.g. Denmark and Ontario. Further, the burden of underwriting subsidies – via ROCs or some alternative mechanism – will fall on Scottish consumers rather than the broad base of consumers in the GB market. The impact on energy prices in Scotland will be substantial, leading to out-migration by energy-intensive industries and a general reduction in demand which will exacerbate the excess of wind generation capacity which is the source of the problem.

The counter-argument is that England & Wales will depend upon Scottish renewable energy to meet EU targets for renewable energy and reductions in CO2 emissions, so that preservation of the integrated GB market is mutually beneficial. This may be too optimistic a view of Scotland’s negotiating position. Is it really the case that an RUK government would treat renewable electricity generated in Scotland, whether from wind or marine resources, on a par with domestic renewables? Again, this view may be much too optimistic. Any government in London has clear alternatives which range from abandoning targets for renewables to importing renewable energy from elsewhere – wood chips, Irish wind or marine power. Because of the costs of the backup required to offset the intermittency of wind power, wind generation is not a low cost way of reducing CO2 emissions. The UK government has already scaled back its projections for the contribution of wind power to meeting the EU renewable energy target and few seriously believe that it will be met in any case. So the notion that E&W consumers will continue to fund large subsidies to underwrite renewable energy production in Scotland after independence is not likely to convince investors.
A more plausible scenario is that Scotland will continue to export renewable energy but only at a price adjusted for the costs of transmission & intermittency that matches the cost of new nuclear power. If that were the outcome, the return to capital investment in all forms of renewable energy would fall substantially.

9. Impacts on manufacturing and services

Protecting the non-energy sector from the effects of energy investment booms in an economy with the features of an independent Scotland is practically impossible. Sadly, this means that the vision of a Scotland with a revitalised manufacturing sector comes down to a choice about whether to forego the rents and capital flows generated by energy and other natural resources. Fiscally, Scotland is sufficiently dependent on these rents and capital flows that foregoing them would require a very painful adjustment in public spending, so that this seems to be an unlikely prospect. The best that can be expected is that manufacturing and services directly linked to the energy sector can thrive in both the domestic and international market. Still, it must be borne in mind that these markets may be almost as volatile as the energy sector itself.

[To be extended]

10. Regulation

If Scotland were to become independent, it would inherit the functions of a range of regulatory and other public agencies with responsibilities in the energy sector including Ofgem, the Office for Nuclear Regulation, the Nuclear Decommissioning Authority, and the Office of Unconventional Gas and Oil (announced but not established yet). The Scottish Government has already indicated that it favours a different approach to regulation than the UK model of specialised, sector-based regulators which cover both economic and technical issues. Instead, it has proposed that economic regulation would be undertaken by a multi-sector regulator covering all networks and perhaps competition as well. Technical issues together with health and safety would be covered by a separate agency.

The model of a multi-sector economic regulator with or with responsibility for competition issues is fairly standard among small and medium sized OECD countries, reflecting a desire to minimise costs by sharing staff resources across sector. One complication is that Ofgem, in particular, undertakes a variety of tasks that have been outsourced from the Department of Energy and Climate Change to the regulator. Much of this work focuses on the administration of programmes to promote renewable energy and on the planned restructuring the energy market in the UK which will require substantial effort in developing the mechanisms that are supposed to replace existing subsidies. The administrative burden on the Scottish Government in setting up and operating a range of new regulatory bodies for the energy sector will be substantial in the period immediately following independence since the existing UK agencies do not have large representation in Scotland.

Setting aside the transitional costs of any divorce, there are some important regulatory issues that may be settled differently depending upon whether Scotland is part of the UK or an independent state. The most significant of these concerns the structure of transmission charges within Scotland.
for gas and electricity. There has been a long-running debate about the treatment of renewable energy resources located in remote parts of Scotland – both marine and wind power in the Western Isles, Orkney & Shetland, and the extreme North of the mainland. Lobbyists for renewables, including the Scottish Government, have argued for uniform postage stamp transmission charges. On the other hand, Ofgem and the transmission companies have taken the view that distance matters and, hence, that the locational cost of providing transmission assets should be signalled through transmission charges.

In the case of wind generation, arrangements have been developed by which the transmission lines which connect offshore wind farms to the onshore grid are treated as separate franchises funded out of revenues from charges levied on the wind farms using the lines. This is similar to the arrangement for offshore oil and gas which relies upon pipelines built and operated by joint ventures controlled by the major producers. Power or gas delivered to the onshore grid connection is treated identically to power or gas from an onshore generating station or processing plant located at the same point.

The conceptual problem is whether wind farms or tidal power plants on Lewis or the Orkneys should be treated as being equivalent to offshore wind farms or as covered by the onshore regime for transmission charges. Since it is very expensive to build and operate sub-sea transmission lines or pipelines, any application of marginal or opportunity costs would lead to separate charging for such links which would discourage anything other than large scale developments. To a lesser extent the same would be true for Caithness and Sutherland as well as other remote areas in Scotland.

The problem for a Scottish regulator is that the tension between economic logic and social considerations will be much greater within Scotland than for the GB market. Much of the economic advice to Ofgem has emphasised the merits of moving to transmission charges based upon locational marginal pricing (LMP) or some approximation such as zonal pricing. Such recommendations are not purely academic exercises, since LMP principles are used in the California, New England, PJM and Texas regions in the US as well as in other countries around the world. Within Scotland this will inevitably lead to fairly low transmission charges for producers and consumers located in the Central Belt combined with significant congestion charges for the interconnectors to England and relatively high charges for transmission from the Highlands and Islands to the Central Belt.

The response is likely to be strong objections from lobbyists for renewable energy and local development bodies. On the other side, it will be more difficult to spread the costs of cross-subsidising generators and consumers when these costs cannot be transferred to consumers in the rest of the UK but have to be borne by the much smaller population of Central Scotland. Similar problems arise in a number of small countries which have to balance the interests of remote communities again those of the majority living in the main population centres – such Chile, Ireland, New Zealand and Norway (as always). Ultimately, this is a political decision, since it requires a balance between considerations of efficiency and (geographical) redistribution but the trade-offs that will face both politicians and regulators are likely to be require more careful consideration than they have received in the past.
A separate area that is likely to pose new problems for the Scottish energy regulator concerns the role and effectiveness of competition in energy markets. The UK Government has been strongly committed to the key role of retail competition, though there is significant unhappiness about the market structures and outcomes which have emerged. In principle the UK Government is also committed to competition in production/generation and wholesale markets, though in practice it is reverting to what regulatory economists refer to as a single buyer model for electricity generation because of its wish to promote forms of generation that are regarded as being either too risky or unprofitable by investors.

An important factor underpinning concentration in retail energy markets is the need to hedge the risks associated with wholesale prices which cannot be passed through to consumers. Such hedging may take the form of ownership of upstream production, but otherwise it requires markets that are large and liquid enough for financial hedging through contracts for differences or similar arrangements. With a relatively small market dominated by 3 generators (EDF, Scottish Power and SSE) it is not clear that Scotland can sustain the level of retail competition currently observed in the GB market, which is dominated by 6 major suppliers.

This problem is not really solved by requiring generators to sell a higher proportion of their output in the wholesale market because the natural hedge of combining upstream production with retail supply will remain. It would be possible to go further by requiring generators to offer medium term supply contracts at quasi-fixed prices but that will transfer risk from retail supply to generation with the result that small and medium generators of renewable electricity are squeezed out as they are least well placed to raise the necessary risk capital.

Similarly, even if an integrated GB market were to continue after independence, it is far from clear that a Scottish Government would want to persist with the energy market reform being implemented by the UK Government. The defects of the single buyer model have been analysed by regulatory economists, but the disadvantages are particularly large in small countries and, especially, for countries that expect to export large volumes of their electricity production. Further, the UK Government is attempting to combine a single buyer with a wholesale pool. This is a clear recipe for extreme volatility in the pool price.

Even with an integrated wholesale market, it will not be difficult for the E&W single buyer to exclude generators located in Scotland from such contracts by, for example, imposing precise firm supply and transmission requirements. The consequence is that Scottish producers will be exposed to larger fluctuations in the GB pool price and the cost of insuring against that risk will fall on the Scottish single buyer and eventually on Scottish consumers.

11. Conclusion

Natural resources and especially energy play a crucial role in Scotland’s economy. A key element in the case for independence is that constitutional change will offer more control over the way in which Scotland’s resources are exploited and, thus, ensure that a higher proportion of the resource rents accrue to those living in Scotland. That argument is valid but it is a double-edged sword. The
benefits of obtaining a greater share of resource rents must be weighed against a sharp increase in the risks of being exposed to the macro and micro effects of reliance upon a notoriously volatile sector.

This paper has highlighted some of the potential consequences of such exposure. These problems can be and have been dealt with, but this will require a combination of economic discipline and an acceptance of economic volatility that may be uncomfortable for a population that has been substantially insulated from such risks up to now. The arguments made by the Scottish Government tend to put more weight on the benefits of the change, relying upon optimistic and convenient assumptions about market arrangements and performance after independence. It is easy to react to such presentations by emphasising the potential disadvantages of separation. That is equally misleading. Scotland’s energy sector can and will adapt to independence, but the process will not be simple and the costs may include an acceptance of much higher levels of risk – and, thus, higher rates of return on capital – than in the past.

12. References