Creating Electricity Satellite Accounts

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Abstract

Currently there is a significant amount of work being put into reconciling models of the economy with models of the physical generation and transmission of electricity. Yet, there is a fundamental challenge which has not been addressed to date, and that is better capturing the electricity sector within the economic system of national accounts (SNAs). Generally in the SNA framework the electricity sector has been represented by a single aggregate sector representing generation, distribution, transmission and supply. In this paper, we set out the principals and construction of an electricity satellite account (ElSA) in which we improve the resolution of the electricity sector. We implement our suggested approach using data for Scotland, a good case study given that it has a diverse mix of generation technologies, detailed electricity statistics and formal set of economic accounts. Additionally, it is also part of a larger (Great Britain) electricity grid which has interesting aspects for the (inter-regional) trade in electricity. These accounts could be created for almost any nation or region in a standardised manner, given the availability of similar data.

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1 Introduction

The electricity sector in the U.K is a big business which, in 2014, contributed 2.8% of GDP with over 162 thousand employees (UK Government, 2015). Yet if the latest input-output tables were to be downloaded it would be found that the electricity sector is not treated as such an important sector. There is only one sector to represent the electricity sector which is an aggregation of generation, transmission and generation activities. No distinction is made between these distinct parts of the electricity sector, or the difference between the technologies used to generate the electricity. These technologies have different roles in the electricity market due to their scale and principle of operation but in the standard economic accounting framework the value of these different technologies to the economy is not fully represented. There are also two other problems with the SNA when representing electricity as a single aggregated sector. The first being that different generation technologies will have different greenhouse gas emissions (GHG) and employment intensities which by not being known, prevent a better understanding of the real effects of changes in the sectors. Secondary there is no way to understand the relative emissions intensities (in terms of GHG/£) of each of the technologies.

It is for the reasons above that the SNA is found to be unsatisfactory for representing the electricity sector. Luckily, this has been the case before for the tourism sector, where in the late 1970s it was recognised that the SNA framework was unable to represent the manner in which tourism contributed to the overall economy. This led to the development of tourism satellite accounts (TSA) driven by the World Tourism Organisation (WTO). Though parallels cannot be directly made, the framework of the TSA can be adapted for the creation of an ElSA which this paper demonstrates for Scotland.

In the next section of the paper the TSA is reviewed followed by the adaption to the electricity sector in Section 3. Section 4 follows the development of the first ElSA as the framework is applied to Scotland in 2012 with Section 5 illustrating some of the results that would otherwise not be identifiable in the SNA framework. The creation of the ElSA not only leads to an economic account, there are other uses which are explained in Section 6.

2 Conceptual Satellite Account Framework

The idea of a satellite account to better represent sectors of SNA framework has been around for decades with several different types being created. By far the most developed is tourism satellite accounts (TSAs) which are explained in this section to give an overall idea of why satellite accounts are needed and what data they include.

The fundamental driving force behind the development of a TSA was that tourism has specific characteristics that the standard SNA framework is ill suited to capture. If we think of the activities of temporary residents, they are completely different to those of permanent residents. But in the standard SNA framework they are treated as the same as there is no single economic activity which incorporates the production of tourism goods or the consumption level of tourism. In a TSA the purchasing groups, different types of tourism, are separated which allows estimations on keys variables to made such as how much individual industries rely on tourism (Jones, 2005). The same is the case for the electricity sector, the final product is the same but the way it is produced varies by the technology and the economic consequences are different, but in the standard SNA framework this information is hidden.

The TSA framework emerged, according to Smith and Wilton (1997), in early 1983, the World Tourism Organisation stating that there was a need for an economic system with "a uniform and comprehensive means of measurement (of tourism) and comparison with other sectors of the economy"(EUROSTAT, 2008). Over the next three decades several countries throughout the world developed Tourism Satellite Accounts (TSA) with Canada being the first to be recognised as having a comprehensive account in 1994 (Frechtling, 1999). Initially when TSAs were developed there was no standard method of analyses (Smeral, 2006) and depending on the country/region there were different measurements taken which made it difficult to compare/contrast or even update the accounts on a regular basis. Because there were so many different types of methods used an international standard for creating satellite accounts was fully developed finally in 2000 (Frechtling, 2010). The latest framework (EUROSTAT, 2008) gives detailed information on the supply and demand sides of the tourism satellite accounts as well as exact detail of what should be in each table of the TSA and guidance on how the data in the tables should be created.

In this framework there are four key principles of TSAs which can be transferred directly to other satellite accounts. These are:

1. Basing estimates on reliable statistical sources
2. Using statistical data that are produced on a continuing basis
3. Ensuring the comparability of data within the same country over time and across countries and other types of economic activity

4. Ensuring the internal consistency of all data used and comparability with other macroeconomic data (WTO, 2008).

In a full TSA there are 7 core tables with extra being added as needed (EUROSTAT,2008). Figure 1 below outlines these tables.

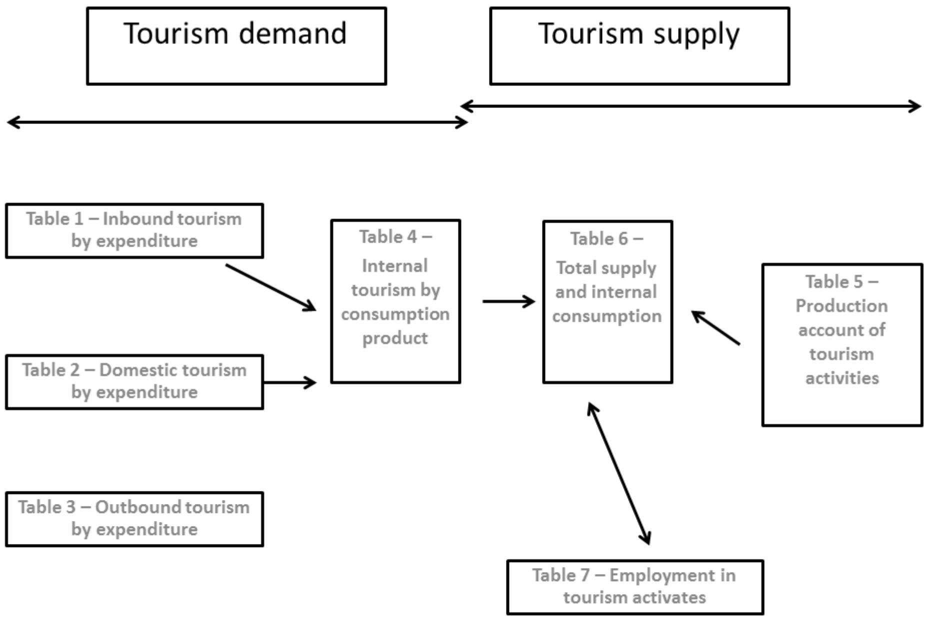

Figure 1: Schematic of a TSA

Tables 1-3 capture inbound, domestic and outbound tourism expenditures by product (rows) and type of tourism(columns). Table 4 captures total internal tourism expenditure added together from tables 1 and 2. Table 5 provides a representation of the production of tourism activities at basic prices. This is a product (rows) by industries (columns) representation. Table 6 is again product by industry and focuses on total supply, reconciling domestic supply and total internal tourism demand by linking into the supply and use tables of the SNA, and indicating the share of domestic supply. It is denoted in purchasers' prices. Table 7 links table 6 to employment in tourism industries. This is a highly defined framework and the next section looks at it's adaption to the electricity sector.

3 Extension to the electricity sector

In the previous section the internationally recognised framework for reporting on the activities of the tourism sector in greater detail than SNA was presented. This develops the idea that this framework may be adapted and used to give a better representation of the activities of the electricity sector. Firstly we present a schematic of the framework for an electricity satellite account which mirrors that found in figure 1 for the tourism sector.

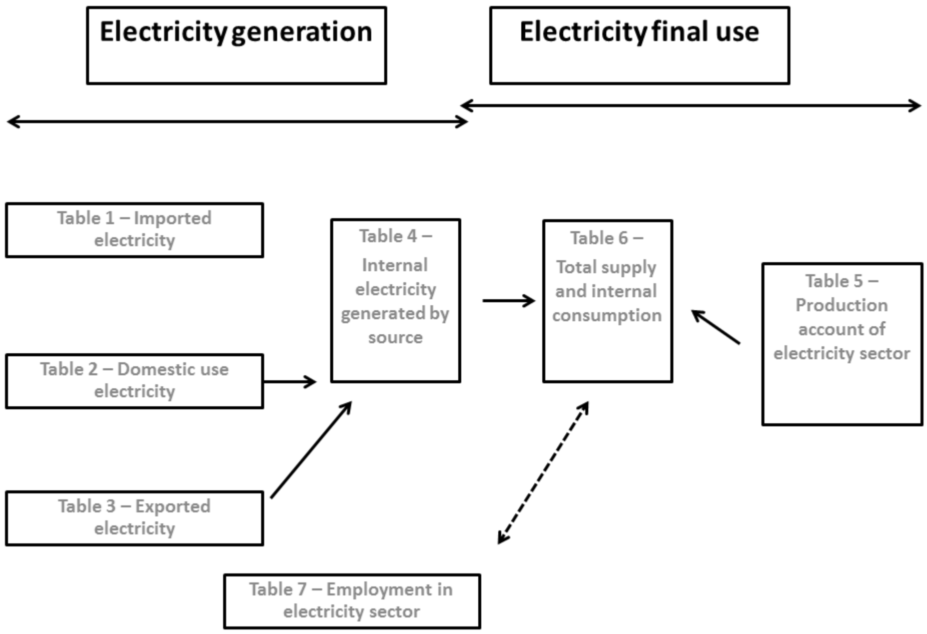

Figure 2: Schematic of an ElSA

The first three tables, as with the tourism account, are focused on the consumption of electricity. In the case for ElSA we have, the domestically consumption of electricity generated out the region of focus i.e imports (table 1), domestically consumed electricity generated within the same region (table 2) and table 3 is the electricity which is produced in the region but consumed out with its boundaries (exports). The tables of the ElSA may have different interpretation and importance than the corresponding TSA table. An example of this is that for the tourism accounts the inbound tourism and domestic tourism tables were much more valuable to the economy due the consumption of the activities within the region. However, for the electricity sector it is the total domestically generated electricity which is of importance for the health of the economy. From figure 2 total domestically generated electricity is represented in table 4 which is a combination of tables 2 and 3, unlike table 1 and 2 for Table 4 of the TSA framework. Each of these ElSA tables is broken down by the generation type as the 'product' with different types of consumer identified.

For table 5 a PxI production account is made for the electricity sector in a similar fashion as it is done for the tourism sector. These production accounts use similar methods to a generation/supply match for the electricity sector whereby we match the generation by technology (products) with the uses for different sectors of the Scottish economy (industries). Table 6 of the ElSA is a direct parallel to table 6 of the TSA. This is the table that brings the data from the other tables together and reconciles it with the supply and use framework of the SNA framework. Table 7 of the ElSA provides employment information. There are also several other extra tables which give information related to the electricity sector but are not necessary related to the SNA framework thus their exclusion from figure 2. One such table is the CO_2 emissions by technology.

With these tables we now have a framework which shows: the total electricity generated electricity generation by product and where it is being consumed (table 4); the consumption of electricity produced outside of Scotland (table 3); the production of each product by industry in the domestic economy (table 5); the supply and use of each product in the economy by sector (table 6) and the employment of the electricity generation types. The creation of this framework allows for a deeper understanding of the electricity sector which is 'impossible' under the standard SNA framework. To demonstrate that the construction of an ElSA is practically possible we create an electricity satellite account for Scotland, which is explained in the following section.

4 An ElSA for Scotland

For the creation of the Scottish ElSA there were several different data sources used, while the framework must be implemented in both physical and monetary units. Key to our creation of the Scottish ElSA were two sets of databases. The first being the national accounts, including the input-output tables, which for Scotland are regularly updated and freely available. Our Scottish ElSA was built for 2012 as this was the latest data available at the time the work started. Throughout the world these national accounts are produced by either governments or academic institutions (wido.com) meaning that there are few countries for which absolutely no input-ouput tables are available. The second key database needed for the creation of the Scottish ElSA was on Scottish electricity generation, with information needed on the quantity of electricity generated and the types of technologies used. The data for Scotland comes from the Elexon portal which is a free to access database holding an extensive amount of information on the U.K electrical network, from this database, we use data on the half hourly output by generator in our analysis. In the next section a brief introduction is given to the electricity sector in Scotland.

4.1 Scottish electricity sector

Scotland is a country in which, through policy, there has been a significant push towards a 'greener' electricity network. The most noteworthy target from the Scottish Government is to generate the equivalent of 100% of the electricity consumed by renewables by 2020. Looking at the latest figures on electricity generation (Scottish Government, 2016) we find that by 2014 Scotland was well on it's way to meeting these targets with the highest percentage of electrical generation being renewables at 38% followed by nuclear 33.3%, coal 20.6%, gas 5.4% and 1.6% from oil. Comparing this generation with electricity demand it has been claimed by the Scottish Government that 49.7% of gross electricity consumption in Scotland came from renewables.

This move towards renewables is impressive but generating 100% of Scottish electricity from renewables poses some challenges, noticeably the problem of intermittency with these renewable technologies. For the Scottish electricity network, at every point in time the amount of generation must meet demand and if there is not enough Scottish generation the gap must be made up by imports from the rest of the U.K or there is potential for a blackout occurring. In the move towards the 2020 targets the Scottish Government has, in 2016, already stopped coal electricity generation meaning the import gap will only widen in times of low wind. The creation of a Scottish ElSA can be used to look at the potential implications of relying on imports.

The 'Energy in Scotland' publication puts the contribution of generation activities at 2.2% of GDP in 2013, and 12.4% of the output of production activities in Scotland. These estimates come from the GDP weights used to construct aggregate Scottish GDP; in turn based on information provided by electricity generators and the UK Department of Energy and Climate Change (DECC). No information is provided about the GDP contribution of different technologies, or of exports of electricity. Given that the price of electricity varies according to when it is sold on the grid, there are good reasons to think that differences in the time path of generation by technology will create significant differences in the contribution of different technologies to GDP. In constructing the ElSA, details of which we will outline in the next section, we hope to provide some answers to these types of questions.

4.2 Creation of tables

This section gives details on how the tables were periodically put together. As has been mentioned previously our base year is 2012, the latest available Scottish IO year when this work started.

4.2.1 Tables 1 to 4

The starting point for these tables is to gather information on electricity generation, by generation type, for each half hourly time-step in 2012 to characterize Scottish electricity supply (the Scottish electricity market, as part of the U.K market, operates on 48 half hourly periods per day were electricity is traded). As mentioned the Elexon portal was used for this and the data was concentrated on the use of the balance mechanism. There are two types of connected electricity generation, transmission connected which are larger centralised generators and the smaller more localised distribution connected generators. For the Scottish ElSA we need data on both the transmission and distributed generators with the former being obtained directly from the Elexon portal. The distribution connected generator information was obtained by applying analysis techniques and models to the Elexon data. One such model was a wind model which took data from the larger Scottish windfarms to estimate the output of the smaller ones. As well as Elexon other sources of data (DECC, 2014) were used for to calculate the losses, etc of the Scottish electricity network.

In addition to knowing the supply of electricity for the creation of tables 1-4 of the Scottish ElSA, the consumption of electricity at each half hourly time step needs to be known. Unfortunately for Scotland this type of data is not readily available, but data on the overall U.K network is avaliable which is used to build a model to provide estimates on the Scottish half houly electricity consumption in 2012. For this model underlining assumptions regarding electrical consumption and temperature (Valor 2001) were made to convert U.K data to Scotland. This only gives overall electrical consumption but for ElSA it is advantageous to have consumption by sector, thus to get this the demand model followed a similar method to Hesmondhalf (2012) using data from Ofgem (2014).

Combining the generation and consumption data will give the fundamental supply/demand match for each half hourly time period instead of the overall gross figures otherwise available. This generation/consumption data is in physical unit but, as has been mentioned, an advantage of ElSA is to take into account the variation of electricity price. On a normal day the electricity price varies directly with electricity demand, if there is high electricity demand the price of electricity will be higher. Figure 3 gives an example of this variation.

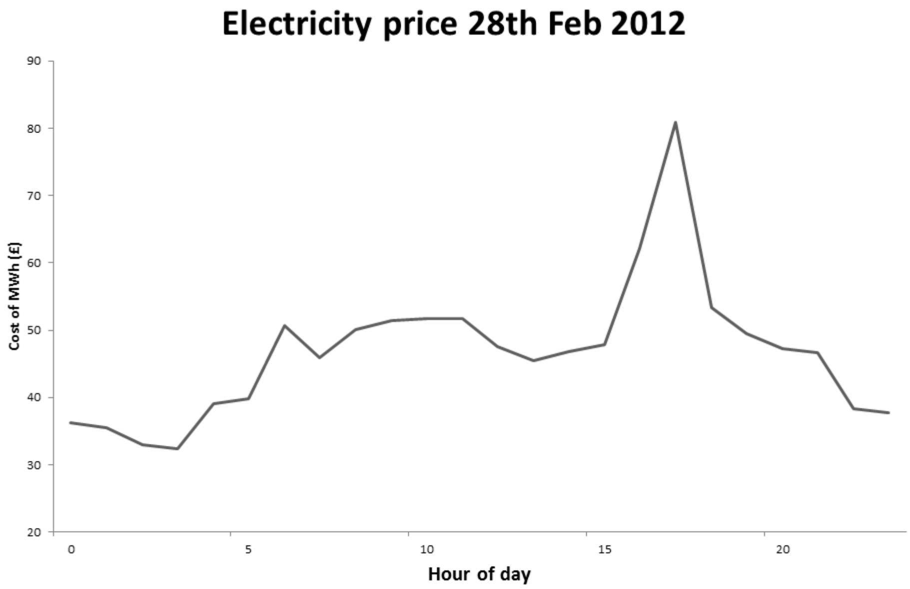

Figure 3: Daily Variation of price

Data for the day ahead market, which most electricity is traded on, is available for the U.K via the Nordpool database. Using this pricing information with the supply/match data the Scottish ElSA now has imports, exports and domestic use of the Scottish electrical network for each half hourly time period taking into account pricing variations (tables 1-4).

4.2.2 Table 5-7

Table 5 of the ElSA is a production account with rows representing the products produced by each industry and, in the columns, each industry in the economy. Table 2 of the ElSA and a Scottish domestic use table were used for this creation. A similar methodology was used to that for table 5 of the TSAs (Eurostat, 2008). The Scottish domestic use table is a PxI table developed from the standard combined-use table and gives the consumption of goods and services in Scotland. For the creation of table 5 of the Scottish ElSA all non-electricity products in the domestic-use table are aggregated to a single sector. The electricity product row in the domestic use is split using the information from ElSA table 2 giving the sales by technology to the different industries, doing this leaves a residual non-generation electricity product row. For table 6 the information from table 5 is incorporated with exported products and taxes/subsidies on generation products. The employment table 7 uses data from several sources to produce employment numbers by generation technology.

These are the 7 core tables of the Scottish ElSA, with the other 'extra' tables being omitted due to paper length constraints. The full tables can be found in the appendix with the following results sections giving examples of the type of information that can be found with the creation of a satellite account.

5 Results

The methodology above indicates that a driving factor in the development of an ElSA is for the variation of electricity price to be taking into account. Below, in table 1, the average price of each MWh of electricity sold for the different electricity generation technologies is displayed.

Tecnhnology	Output (£/MWh)
Coal	46.96
Gas	46.53
Nuclear	45.52
Flow	47.12
Pumped Generation	54.92
Wind	44.32

Table 1: Average cost of MWh electricity sold by generator (2012)

This gives an idea of when the power plants were generating. Wind and nuclear generation have the lowest average price of electricity, which is to be expected. The economics and intermittency of wind energy determine that when available, wind electricity must be put onto the electrical network. But this does not always relate to times of peak demand, thus electricity generated from wind turbine has a lower average cost of energy. As for nuclear, the low average cost of electricity is a result of the fact that output cannot economically be varied and as such runs at 100% capacity when operational. The highest cost of energy technology, again expected, is pumped generation. Due to the fast acting nature of pumped turbines they are used to balance the network at times of peak demand when the electricity cost is at its highest. In the introduction of the paper it was mentioned that the development of ElSA allows for the calculation of relative emission intensities, which can be found in table 2 below.

Tecnhnology	Output (CO2/£)
Coal	21.10
Gas	9.88
Nuclear	0
Flow	0
Pumped Generation	0
Wind	0

Table 2: Relative emission intensities ($CO_2/£$) (2012)

This tables show the amount of CO_2 emissions per £ for each generation technology, as we are focused on operational emissions the renewables are set to 0. From the table we find that coal has more than twice the emission intensity of gas, which goes a way in explaining why coal has been phased out in Scotland but gas has yet to be. Gas is the more cleaner technology. The development of the Scottish ElSA allows the percentage of ratio of value of exports/value of total generation by technology to be calculated, which would otherwise have been hidden in the SNA framework. The ratios are shown below in table 3 .

Tecnhnology	Ratio
Coal	21.59%
Gas	21.54%
Nuclear	21.01%
Flow	21.17%
Pumped Generation	20.62%
Wind	24.32%

Table 3: Value of export/Value of generation (2012)

As would be expected the ratio of wind exports is the highest and pumped generation the lowest, again related to their time of generation. Wind electricity has to be used when it is there and if there is no Scottish demand it is exported but pumped generation is usually a peak demand technology. The ratios of all the technologies are of similar range and this is because the Scottish electricity network was designed as part of the wider U.K network and as such generators are expected to balance the full U.K grid not just Scotland.

6 Other uses

With the creation of the ElSA there was a considerable amount of data collected and processed on the electricity sector and due to this the ElSA framework evolved to be much more than an accounting framework. This section deals with two other uses of the ElSA framework. Firstly as an input to disaggregate the electricity sector in IO accounts more accurately. Secondary the ElSA accounts can be adapted to become a future energy scenario prediction model.

6.1 Disaggregation of IO Accounts

In the past several studies have been carried out where there is a need to disaggregate the electricity sector in the IO accounts. Two key attributes are: Cruz (2002) where the electricity sector is disaggregated into three sectors (fossil fuel generation, non-fossil fuel generation and distribution) to investigate energy-economy-environment interactions in Portugal and Allan (2007) which disaggregates the Scottish electricity sector into a variety of different generation technologies and one distribution sector to investigate the effect of generation technologies on the overall economy. In these studies, and others not mentioned, a top-down methodology using overall physical generation percentages has been applied to disaggregate the sales and expenditures of the electricity sector. But this method has been noted to have flaws as the physical generation percentages are different to the overall generation sale percentages, due to the variation of electricity price. Applying the information from the Scottish ElSA in a bottom-up approach allows for a more accurate disaggregation of the Scottish electricity sector which in turn should lead to greater accuracy in modelling

6.2 Future energy model

In addition to ElSA enabling a bottom-up approach to be applied in the disaggregation of the electricity sector, the Scottish ElSA, through the large data acquisition, allows us to develop an electricity systems model. This model uses the 2012 base year and modifies the Scottish ElSA data in such a way that changes can be made to simulate future energy scenarios. Some obvious changes that could be made are increase/decrease of generations (by technology or individual plant) or changes in demand.

In 2012 there were two operational coal power plants in Scotland, Cockenzie and Longannet. Since then, through policy, both have closed with Longannet being the last in 2016. With these changes there has already been change in the mixture of Scottish electricity consumption by technology and as they were used as base power plants there is obviously going to be a change in the level of imports/export. The effects of shutting these power plants, without changing any other variable, were modelled using the ElSA systems model. Figure 4 below shows the change in Scottish Electricity consumption.

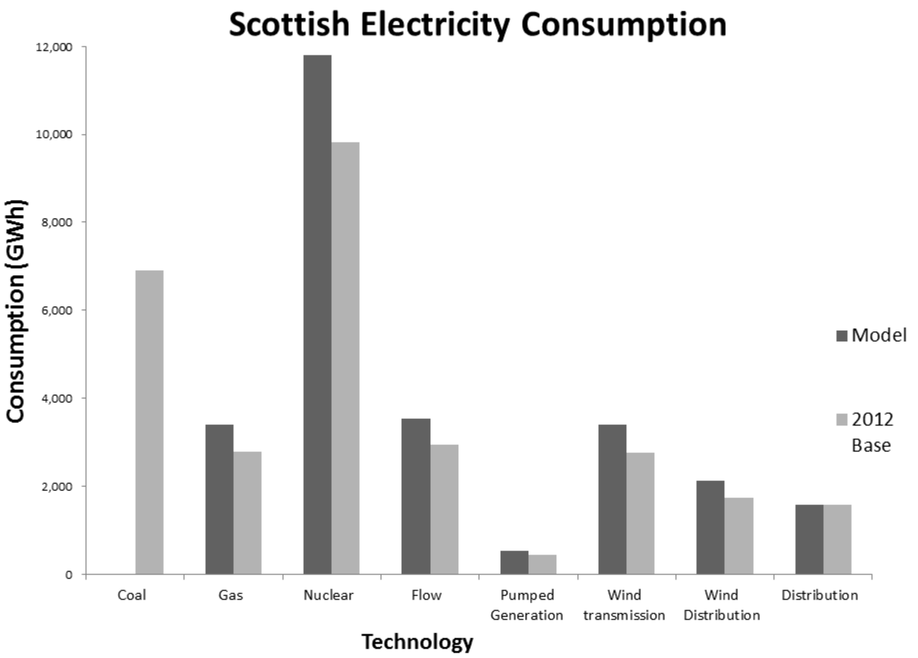

Figure 4: Change in energy domestic consumption (no coal)

The loss of the coal base generation results in the domestic consumption of the other technologies increasing, as would be expected. But if the totals were taken for the base year and modelled scenario with no coal it is found that in model scenario the domestic consumption of Scottish generated electricity is about 10% less than that of the base. This is due to the demand/supply match problem where coal is a base load technology but the technologies replacing it are not. They will not always be able to increase generation when required to meet demand, meaning that Scotland needs to rely to a greater extent on imports of electricity to 'keep the lights on'. This is seen in the results of the model where Scottish imports by value increase by 900%. Overall in the model scenario, if going by overall value of imports, Scotland is still a net exporter of electricity. But if going by hours, Scotland actually imports electricity more often than it exports (53.5% imports to 46.5% exports). This is only a flavour of some of the data that comes out of the ElSA systems models, others include CO2 emissions, losses, pumped storage use etc.

7 Conclusion

In the SNA framework it is known that the aggregation of the electricity poses problems in understanding the relationship between the electricity sector and the broader economy. The same was said for the tourism sector back in the 1970s, from which the TSA framework was created. This paper takes the TSA framework and adapts it for the electricity sector while developing a 2012 Scottish ElSA. We demonstrate a few key results. Firstly the average price of electricity depends on technology and it is essential that this is captured. Secondly that the ElSA framework extends beyond economic accounting. Using the ElSA information the electricity sector in IO accounts can be disaggregated using a bottom up approach which in turn should make economic modelling more accurate. Also if the ElSA database is developed, a standalone electricity system model can be created and used for the modelling of future energy scenarios.

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Appendix - Tables

	Domestic	Industrial	Comm's	Education	Health	Retail	Other	Total
Coal	3,242,613	2,450,036	118,053	219,499	99,015	755,545	1,134,820	8,019,581
Gas	2,511,620	1,971,559	91,673	178,117	77,105	586,040	883,005	6,299,119
Nuclear	1,507,911	1,124,185	55,127	100,504	46,125	352,274	528,971	3,715,096
Flow	20,523	15,021	728	1,326	614	4,693	7,013	49,917
Pumped Generation	88,872	71,590	3,164	6,474	2,692	20,388	30,635	223,816
Wind	78,282	60,182	3,012	5,502	2,490	19,049	28,742	197,259

Table 4: Expenditure on electricity imported into Scotland, £, by technology (2012) (Table 1)

	Domestic	Industrial	Comm's	Education	Health	Retail	Other	Pumped Storage	Losses	Totals
Coal	130,717,174	93,788,027	4,825,701	8,211,256	3,997,156	31,118,361	46,051,389	6,639,292	30,888,461	356,236,816
Gas	52,253,007	37,872,009	1,942,746	3,334,986	1,606,356	12,508,639	18,525,627	2,552,409	12,381,273	142,977,051
Nuclear	181,294,944	130,150,369	6,782,873	11,398,480	5,601,174	43,665,997	64,598,355	10,514,529	42,427,657	496,434,377
Flow	34,065,224	24,622,747	1,233,612	2,152,531	1,027,876	7,987,436	11,821,017	1,330,889	7,971,726	92,213,058
Pumped Generation	9,899,959	6,850,378	325,237	585,911	276,202	2,151,678	3,153,098	13,203	2,152,833	25,408,499
Wind	80,137,913	58,123,104	2,991,625	5,083,877	2,474,706	19,277,034	28,533,426	4,382,685	20,681,216	221,685,587
Total	488,368,220	351,406,634	18,101,794	30,767,041	14,983,470	116,709,144	172,682,912	25,433,006	116,503,166	1,334,955,388

Table 5: Expenditure on electricity produced in Scotland and consumed in Scotland, £, by technology (2012)(Table 2)

	Northern Ireland	England	Total
Coal	26,280,848	128,144,338	154,425,186
Gas	10,871,895	50,843,854	61,715,749
Nuclear	38,677,215	166,321,625	204,998,840
Flow	6,706,164	32,872,957	39,579,122
Pumped Generation	1,876,911	8,306,198	10,183,109
Wind	16,369,156	103,856,480	120,225,636
Total	100,782,190	490,345,451	591,127,641

Table 6: Expenditure on electricity exported from Scotland, £, by technology (2012)(Table 3)

	Domestic	Industrial	Comm's	Education	Health	Retail	Other	Pumped Storage	Losses	Northern Ireland	England	Total Generated
Coal	13,0717,174	93788,027	4,825,701	8,211,256	3,997,156	31,118,361	46,051,389	6,639,292	30,888,461	26,280,848	128,144,338	510,662,002
Gas	52,253,007	37,872,009	1,942,746	3,334,986	1,606,356	12,508,639	18,525,627	2,552,409	12,381,273	10,871,895	50,843,854	204,692,800
Nuclear	18,1294,944	130,150,369	6,782,873	11,398,480	5,601,174	43,665,997	64,598,355	10,514,529	42,427,657	38,677,215	166,321,625	701,433,217
Flow	34,065,224	24,622,747	1,233,612	2,152,531	1,027,876	7,987,436	11,821,017	1,330,889	797,1726	6,706,164	32,872,957	131,792,180
"Pumped Generation"	9,899,959	6,850,378	325,237	585,911	276,202	2,151,678	3,153,098	13,203	2,152,833	1,876,911	8,306,198	35,591,608
Wind	80,137,913	58,123,104	2,991,625	5,083,877	2,474,706	19,277,034	28,533,426	4,382,685	20,681,216	16,369,156	103,856,480	341,911,223
Total	488,368,220	351,406,634	18,101,794	30,767,041	149,83,470	116,709,144	172,68,2912	25,433,006	116,503,166	100,782,190	490,345,451	1,926,083,030

Table 7: Expenditure of Scottish generated, £, by technology (2012)(Table 4)

	Electricity	Industrial	Comm's	Education	Health	Retail	Other	Domestic	Total Output
Coal	28.63	93.79	4.83	8.21	4.00	31.12	46.05	130.72	347.34
Gas	11.48	37.87	1.94	3.33	1.61	12.51	18.53	52.25	139.52
Nuclear	39.33	130.15	6.78	11.40	5.60	43.67	64.60	181.29	482.82
Flow	7.39	24.62	1.23	2.15	1.03	7.99	11.82	34.07	90.30
Pumped Generation	2.00	6.85	0.33	0.59	0.28	2.15	3.15	9.90	25.24
Wind	19.17	58.12	2.99	5.08	2.47	19.28	28.53	80.14	215.79
Electricity non-generation	2057.77	159.34	57.55	2.43	54.84	17.98	368.98	728.37	3447.26
Other non-electricity	1066.49	20986.41	4773.78	1342.73	3465.17	6164.06	24173.83	71538.27	133510.75
Taxes less subsidies on production	95.04	-240.57	138.10	20.83	14.03	708.06	746.89		
Compensation of employees	529.70	14757.18	4608.56	6527.85	5738.33	7146.48	26907.65		
Gross operating surplus	1426.81	10259.88	2019.80	1308.42	1096.03	3628.19	26506.84		
Gross value added at basic prices	2051.56	24776.48	6766.46	7857.10	6848.39	11482.73	54161.38		

Table 8: Production account, £m, Table(5)

	Output of producers (Basic price)	Exports	Taxes (CCL)/Less Subs (ROC)	Domestically generated (Basic)	Domestically generated (Purchasers)
Coal	347.34	154.43	37.00	501.77	538.77
Gas	139.52	61.72	15.00	201.24	216.24
Nuclear	482.82	205.00	0.00	687.82	687.82
Flow	90.30	39.58	-128.80	129.88	1.08
Pumped Generation	25.24	10.18	-6.04	35.42	29.38
Wind	215.79	120.23	-322.00	336.02	14.02
Electricity Gen (Totals)	1301.02	591.13	-404.84	1892.14	1487.30
Electricity non-gen	3612.47	-	1859	3612.47	5471.47
Other non Electricity	133510.75	-	37155.25	133510.75	170666.00

Table 9: Total supply, £m, by technology (2012) (Table 6)

	Full-time employees	Part-time employees	Total
Renewable	1770	48	1818
Non Renewable	590	12	602
non-Generation	5742	508	6250
Total	8102	568	8670

Table 10: Jobs, by technology (2012)(Table 7)