# Supplementary Materials – Not for publication

# APPENDIX

Table 4 - Electricity sector structure in EU Member States

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Country | Electricity sector structure | Main companies operating in | | | |
|  |  | **Generation** | **Transmission** | **Distribution** | **Retail** |
| Austria | The Republic of Austria owns 51% of Verbund's share capital. The federal province Lower Austria holds (through a holding company) 51% of the share capital of EVN. The main Austrian TSO is Austrian Power Grid AG owning 94% of the Austrian high voltage electricity grid. Verbund AG holds 100% of the shares in Austrian Power Grid AG. There are 14 DSOs and distribution areas in Austria. Wien Energie, Linz Strom, Salzburg Netz and Kelag are the main participants in this sector. Of the roughly 130 retailers, many operate only at local or regional level. The three largest suppliers are Verbund, EVN and Wien Energie. | Verbund; EVN | Verbund; EVN | Verbund; EVN; provinces | Verbund, EVN, Wien Energie |
| Belgium | Belgium’s energy sector is almost entirely in private hands, though some local distribution of electricity and natural gas is carried out by companies that are wholly or partially owned by municipalities. Traditional suppliers, notably GDF Suez and its subsidiary Electrabel, continue to hold dominant positions for both generation and supply. Other key generating companies operating in Belgium include EDF and E.ON. In the supply sector, in addition to Electrabel, some of the large players include EDF, Eni and Lampiris. In Belgium, DSOs are mainly grouped together in organisations like ORES in Wallonia and Eandis in Flanders. For example, Eandis is comprised of seven Flemish electricity and gas distribution system operators, which are also its shareholders. Elia, the TSO, has a legal monopoly as Belgium’s sole electricity TSO. | Electrabel; EDF; E.ON | Elia | regional | Electrabel; EDF; ENI; Lampiris |
| Germany | The German energy industry has traditionally been privately owned, though there are still a large number of small electricity and gas distribution companies that are either wholly or partially owned by municipalities. Despite reforms, the incumbent operators in the wholesale and retail markets have retained large market shares. E.ON and RWE have been among the dominant players in both the natural-gas and the electricity markets. EnBW (Baden-Wuttenberg), E.On, RWE, Vattenfall leading in generation, distribution and supply. There are four TSOs: Transnet (EnBW); Tennet (Holland govt); Amprion (Commerzbank, RWE); 50Hertz (Elia and IFM) | E.On, RWE, EnBW (Baden-Wuttenberg) | Transnet (EnBW); Tennet (Holland govt); Amprion (Commerzbank, RWE); 50Hertz (Elia and IFM) | E.On, RWE, EnBW (Baden-Wuttenberg); municipalities | E.On, RWE, EnBW (Baden-Wuttenberg) |
| Luxembourg | Creos Luxembourg S.A. (formerly SOTEG) owns and operates the transmission system, and it supplies the majority of the market. Most of Creos's shares are owned by various private utilities, though the State maintains minority ownership. Creos also operates one of the two main electricity-transmission systems in the country. The State of Luxembourg owns about 40% of the company, via direct shareholdings and through the Societe Nationale de Credit et d'Investissement. The other main electricity grid operator is the Societe de Transport de l'Electricite (SOTEL). Most of the electricity-distribution companies are owned by municipalities. | Enovos International | Creos | Municipalities | Creos |
| Netherlands | For the most part, the Dutch energy industry is in private hands, but there is significant ownership of assets by the state, the provinces, and the municipalities. Most electricity is generated by Essent (owned by RWE), Nuon (owned by Vattenfall), Eneco, E.ON, Delta and Electabel. The electricity distribution and transmission networks are publicly managed and owned. The Netherlands has one electricity transmission system operator (TSO), TenneT, which is owned by the state. Under a 2006 law, distribution assets must be fully separated from supply activity, and cannot be sold to private companies or investors. Since the liberalisation, a number of new supply companies have joined the market including Doug Energy and E.ON The four largest energy companies - Nuon (acquired by Vattenfall), Essent (acquired by RWE), Eneco and DELTA - still have the largest share of the retail market. | Essent (RWE); Nuon (Vattenfall); Eneco, E.ON. | TenneT | Municipalities | Nuon (Vattenfall); Essent (RWE); Eneco; Delta |
| Bulgaria | The 100% state-owned company, BEH is the parent company of most generating companies and owns the TSO. Electricity distribution companies were fully privatised in 2012. Thus EVN (Austria) and Energo-Pro (E.On now Czech ENergoPro) own 100% of the shares of the respective subsidiary companies and CEZ (Sofia and Western Bulgaria) owns over 90%. Captive customers and those who have not decided to change their supplier buy their electricity from NEK (if they are connected to a high voltage grid) or the distribution companies (if they are connected to a medium or low voltage grid). | BEH | BEH | Private: EVN (Austria); Energo-Pro (CEZ); CEZ | Private: EVN (Austria); Energo-Pro (CEZ); CEZ; NEK |
| Czech republic | A large part of the generation, distribution and supply segments are integrated businesses owned by CEZ, a.s. and its subsidiaries (CEZ Group). The Czech Republic has however retained a controlling shareholding of approximately 48% of each of the distribution companies, which were privatized in 1995. CEZ is the dominant electricity generator, providing approximately 67,7 % of the electricity used in the Czech Republic in 2014; CEPS is the sole owner and operator of the transmission grid, which is fully owned by the Czech state. The distribution system is predominantly owned and operated by: EZ Distribuce a.s., E.ON Distribuce a.s. and PREdistribuce a.s. (DSOs). In 2014, the 3 largest Czech electricity suppliers were EZ Prodej s.r.o., E.ON Energie a.s and Pra\_skö energetika a.s. | CEZ | CEZ | EZ Distribuce; E.ON Distribuce; PREdistribuce | CEZ; E.ON Energie |
| Hungary | Following the restructuring and partial privatisation of the vertically integrated state-owned Hungarian Electricity Works Ltd. (MVM), several generating companies, six regional distribution companies and a transmission company were established. Whilst private investment in the Hungarian electricity sector has been significant (mostly in generation and distribution), the state-owned MVM is still the biggest player in the market, controlling a considerable part of Hungary’s generation capacity. MAVIR, a subsidiary of the state-owned MVM, owns and operates the transmission system. The distribution networks are owned and operated by six privately owned DSOs. Outside the universal service sector (DSOs), there currently are more than 50 licensed traders selling electricity to end users at market based prices. | MVM | MVM | ÛDSZ (100% E.ON); DÛDSZ (100% E.ON); TITSZ (100% E.ON); DÛMSZ (100% EDF); ÛMSZ (54.3% RWE; 25% EnBW; 12% MVM; 18.7% others(; ELM (55.3% RWE; 25% EnBW; 15.6% MVM; 4.1% others). | ÛDSZ (100% E.ON); DÛDSZ (100% E.ON); TITSZ (100% E.ON); DÛMSZ (100% EDF); ÛMSZ (54.3% RWE; 25% EnBW; 12% MVM; 18.7% others(; ELM (55.3% RWE; 25% EnBW; 15.6% MVM; 4.1% others). |
| Poland | State-owned entities have been organised into four vertically integrated groups and are partially privatised. These groups are PGE Polska Grupa Energetyczna S.A. (PGE), TAURON Polska Energia S.A. (TAURON), ENEA S.A. (ENEA) and ENERGA S.A. (ENERGA). All of these companies combine generation, distribution and trading (including supply) activities. Other key companies in the Polish electricity market include ZE PAK S.A. with almost 2,500MW of installed capacity in a coal-fired generating station, EDF, RWE, PGNiG Termika, Dalkia, CEZ and GDF SUEZ. In 2012 PGE, TAURON and EDF had the largest market share in the generation sector. The sole TSO, Polskie Sieci Elektroenergetyczne S.A. (PSE), is a fully state-owned joint stock company and owner of all the transmission assets. | PGE; TAURON; EDF | PSE | PGE Dystrybucja; TAURON Dystrybucja; ENERGA Operator; ENEA Operator | PGE; TAURON; ENERG; ENEA |
| Romania | In Romania, the most important electricity generating stations are state-owned (89% of the national electricity output is generated by state-owned generators). Also, the Romanian state owns the majority of the shares in the TSO (Transelectrica SA). The distribution sector has been partially privatised; five of the eight distribution operators are privatised: CEZ Distribute SA; ENEL Distributie Banat SA; ENEL Distributie Dobrogea SA; E.ON Moldova Distributie SA; ENEL Distributie Muntenia SUD SA; FDEE Electrica Distributie Muntenia Nord SA; FDEE Electrica Distributie Transilvania Sud SA; and FDEE Electrica Distributie Transilvania Nord SA. Electrica SA (owner of the three companies (vi) to (viii) above) holds the largest market share (39.27%) and was majority state owned by the Ministry of Economy. | Hidroelectrica SA; SN Nuclearelectrica SA; Complexul Energetic Oltenia SA; Termoelectrica Deva SA | Transelectrica SA | Private: 6 DSOs | Electrica Furnizare; Enel Energie; Enel Energie Muntenia; E.ON Energie Romania; CEZ Vanzare |
| Slovak Republic | The main player in the Slovak electricity generation market is Slovensk elektrörne, a.s. (SE), a joint stock company of which 66% is owned by Enel - the Italian based multinational group, with the other 34% owned by the Slovak state. The entire electricity transmission network is owned by SEPS, a wholly state-owned company. Three are regional Distribution System Operators (DSO), co-owned by the state (51%) and a private investor (49% and management control). E.ON indirectly holds 49% of the shares in ZSE Distribucia a.s.; EDF holds 49% of the shares in SSE - Distribucia a.s.; and RWE Energy AG holds 49% of the shares in Vchodoslovenskö distribunö a.s. | SE | SEPS | ZSE (E.ON); SSE (EDF); RWE | ZSE (E.ON); SSE (EDF); RWE |
| Croatia | The holding company HEP d.d. is state-owned and is the owner of the infrastructure, while its respective affiliates manage the infrastructure (e.g. HEP-DSO, HEP Generation). The transmission grid is operated by the TSO which is the state-owned HOPS. There are 28 companies active in the generation sector. Although the majority of these (approximately 80%) are privately owned, their market share is dwarfed by the generation capacities of state-owned companies, which dominate the sector. There are 18 companies covering the supply business. Three of these companies are state-owned and hold the majority of the market share. The privately owned supply companies with the highest market share in 2014 were: GEN-I (approximately 6.07%), RWE Energy (former Energija 2 Sustavi with approximately 4.52%) and Proenergy (approximately 2.32%). | HEP | HOPS | HEP-DSO | HEP-Opskrba d.o.o. (part of the HEP group) |
| Cyprus | The incumbent Electricity Authority of Cyprus (EAC) owns both the transmission and the distribution system. The TSO is legally but not functionally unbundled from EAC, since all its staff is seconded from EAC. The obligation of ownership unbundling of the TSO does not apply, since Cyprus has obtained a derogation from Article 9 of the 2009/72/EC Directive. The DSO is responsible for managing, operating and developing the network, safeguarding access to the distribution network and equal treatment for all users. EAC has unbundled the accounts of the DSO. No wholesale market is currently operating. EAC is the sole electricity supplier. | EAC | EAC | EAC | EAC |
| Estonia | In Estonia the TSO Elering AS and the main electricity producer and seller AS Eesti Energia along with its subsidiary, the distribution network operator Elektrilevi OU, belong 100% to the State. Electricity production in Estonia is dominated by the state-owned company, Eesti Energia. In 2011, its share of the wholesale electricity market was 90%, while its share of the retail market was 76%. Transmission was unbundled from production in 2010. The state-owned company, Elering, provides the transmission networking service, but also acts as the single transmission system operator. There are 38 distribution networks, the largest of which is owned by Eesti Energia, with 86% share of the distribution market. | Eesti Energia | Elering AS | Electrilevi OU | Eesti Energia |
| Ireland | State-owned companies dominate the electricity and natural-gas sectors. The Electricity Supply Board (ESB) holds two-thirds of generating capacity, though its share has been falling as new power producers have entered the market. It also owns the transmission system, the operation of which is the responsibility of another state-owned body, EirGrid, as well as the distribution network. Bord Gais Eireann (BGE) owns the gas transmission and distribution network, operating the transmission system through a subsidiary company. Retail competition has developed to only a relatively small degree. | ESB | EirGrid | BGE | BGE |
| Latvia | Latvenergo enjoys a monopoly position as the largest producer of electricity in Latvia and controls all of the country’s public electricity distribution networks. The Ministry of Economy, via Latvenergo, is also the ultimate beneficiary shareholder of Latvenergo subsidiaries. The Ministry of Finance owns 100% of the shares in the electricity transmission company, Augstsprieguma tīkli. The company is a former Latvenergo subsidiary that was spun off in 2012 in order to comply with Directive 2009/72/EC of the European Parliament and of the Council of 13 July 2009 concerning common rules for the internal market in electricity. | Latvenergo | Augstsprieguma tikli | Latvenergo | Latvenergo |
| Lithuania | The Ministry of Energy exercises state ownership rights in UAB EPSO-G which has two listed subsidiaries: AB Litgrid and AB Amber Grid, which operate respectively the electricity and the natural gas transmission grid. State ownership rights in Lithuanian Energy were previously exercised by the Ministry of Energy but were transferred to the Ministry of Economy and then to the Ministry of Finance in 2012-13 in implementation of the 2009 Third Energy Package of the European Parliament, which required that the ownership of energy generation and sale be separate from the ownership of energy transmission networks. | Lietuvos Energia | AB Litgrid | AB Lesto | AB Lesto |
| Malta | The Electricity Market Regulations (S.L. 423.22) take into account the derogations granted to Malta by virtue of Article 44 of Directive 2009/72/EC from the requirements of Article 9 (Unbundling of transmission systems and transmission system operators) and Article 26 of Directive 2009/72/EC (Unbundling of distribution system operators). These two articles do not apply to Malta. There are no transmission systems or transmission system operators in Malta. The distribution system covering the whole country remains under the responsibility of one distribution system operator which forms part of a vertically integrated company, Enemalta plc. Unbundling is required at internal management accounts level only. The electricity generation market is open to competition and generators may produce electricity for their own consumption and/or sell to Enemalta plc. The retail of electricity is not open to competition. | Enemalta | n/a | Enemalta | Enemalta |
| Slovenia | The unbundling requirements and full implementation of the Third Energy Package were transposed in national law, whereby the creation of two separate (still state-owned) legal entities, governed by two different public authorities (within the meaning of paragraph 6 of article 9 of Directive 2009/72) is envisaged. Although fully liberalised, the Slovenian electricity market remains rather small and vertically integrated, which creates a difficult environment for new entrants. The key companies operating in the Slovenian electricity market are: Elektro-Slovenija, d.o.o. (ELES), the Transmission System Operator (TSO); SODO d.o.o. (SODO), the Distribution System Operator (DSO); 6 distribution companies; Holding Slovenske Elektrarne d.o.o. (HSE), a generation company and GEN energija d.o.o. (GEN), a generation company. All the generators, distributors and suppliers, as well as the TSO, are predominantly or wholly state-owned and no international investment is present. Due to the level of state ownership, the whole electricity sector is arguably fully vertically integrated. | HSE; GEN | ELES | SODO | GEN-I |
| United Kingdom | The National Grid owns and operates the England and Wales transmission system; the Scottish transmission system is owned by Scottish Power and Scottish and Southern Energy, and the Northern Ireland network by Northern Ireland Electricity. Licences for 14 distribution areas in Great Britain are currently held by six different companies (Electricity North West Limited, Northern Powergrid, SSE, ScottishPower Energy Networks, UK Power Networks, and Western Power Distribution). Retail supply, which is unbundled from distribution, is dominated by six large companies (EDF Energy, E.ON, RWE, Iberdrola/ScottishPower, Centrica and SSE) which supply virtually all consumers. The majority of consumers have switched away from their incumbent supplier. | EDF Energy; E.ON; RWE; Iberdrola/ScottishPower; Centrica; SSE | 4 TSOs | Private: 14 DNOs are owned by six different groups. | EDF Energy; E.ON; RWE; Iberdrola/ScottishPower; Centrica; SSE |
| France | In November 2004, the two incumbent monopoly companies, Electricité de France (EDF) and Gaz de France (GDF), both of which were 100% state-owned, became limited companies with a board of directors. The next year, minority stakes in the two companies were sold to private investors. As of December 2014, the state retains an 84.5% stake in EDF, which dominates the sector - 90% of generation; 100% of RTE (the TSO); 100% of ERDF (DSO, 95% of the market); 91% of retail. The remaining 5% of the distribution network are managed by local authorities (collectivités territoriales), who also own the entire network. | EDF | RTE | ERDF | EDF |
| Greece | The electricity sector remains dominated by the state-controlled Public Power Corporation (PPC) and its subsidiaries, although legal reforms and new entrants in the electricity sector have gradually been weakening PPCs position. The PPC’s generation market share has declined from 98.6% in 2003 to 65% in 2013 The company continues to control almost all electricity supply on the non-interconnected islands. On the other hand, PPC’s supply market share reached 92.3% in 2011 and for the next two years increased to above 98%. In the electricity transmission sector, the PPC owns all transmission lines and holds a 49% share of assets in the transmission system and wholesale market operator (HTSO) with the rest owned by the Greek state. | PPC | PPC | PPC | PPC |
| Italy | The major player, and formerly the holder of a total monopoly, in the electricity generation market, is Enel. Enel is controlled by the Italian government. Edison, ENI and E.ON are also key market players. Distribution activities are carried out by a few operators on the basis of government concessions. Enel Distribuzione is the main distribution network operator (DNO), with 86% of the distributed electricity volumes. Other DNOs, significant by market shares, are: A2A (3.9%), Acea Distribuzione (3.2%) and Aem Torino Distribuzione (1.4%). Enel is the primary supplier with about 37% of the overall sales of electricity. The other major suppliers by market share are: Edison group, with a market share of 8.2%, followed by Acea, with a share of 4.6%, and Eni, with a market share of almost 4.3%. | Enel, Edison, ENI, E.ON | Terna | Enel Distribuzione, ACEA, A2A | Enel, Edison, ACEA, Eni |
| Portugal | During the first quarter of 2012, the Portuguese energy sector saw the privatisation of a significant part of the transmission operator's share capital (Redes Energeticas Nacionais - REN) and of the incumbent's share capital (Energias de Portugal - EDP), a former vertically integrated company, which now develops, through its subsidiaries, generation, distribution and supply activities. Oman Oil Company S.A.O.C. and State Grid International Development Limited acquired 15% and 25%, respectively, of the share capital of REN. China Three Gorges International (Europe), SA, acquired 21.5% of the share capital of EDP. Electricity suppliers entail not only Portuguese companies (EDP Comercial and Galp Power) but also several Spanish companies (such as Endesa, Iberdrola, Uniãn Fenosa, EGL Energêa Iberia and Nexus Energêa). | EDP; Galp | REN | Private | EDP Comercial; Galp Power; Endesa; Iberdorla |
| Spain | Three-quarters of electricity is generated by just three companies: Iberdrola, Endesa (almost 100% owned by the Italian utility firm ENEL) and Union Fenosa (owned by Gas Natural). Iberdrola and Endesa alone account for the bulk of retail sales, though the market is fully contestable. REE (Red Electrica de Espana), in which the state holds a 20% stake, operates the high-voltage transmission grid and serves as the exclusive transmission system operator in co-ordination with the market operator; it owns almost the entire 400 kV grid and two-thirds of the 220 kV grid. Iberdrola, Endesa and Union Fenosa are the largest distributors, although there are more than 300 small local distributors. | Endesa (100% ENEL); Iberdrola; Union Fenosa | REE | Private: Iberdrola, Endesa, Union Fenosa | Iberdrola, Endesa |
| Denmark | The generation sector remains highly concentrated as two companies, DONG and Vattenfall, share 70% of market's capacity. Both grids are managed by Energinet.dk, an independent public enterprise owned by the Danish State under the Ministry of Climate and Energy. DONG Energy covers a leading position holding a 21% of market shares, followed by Energiden (10% circa), Energi Fyn, SEAS-NVE and Natur-Energi. The largest DSO DONG Energy Distribution has more than a million customers which is more than 20 % of the Danish population while the smallest DSOs only have a couple of thousand customers. | DONG; Vattenfall | Energinet.dk | DONG Energy Distribution | DONG Energy |
| Finland | Finland's energy market is dominated by a few large state-owned companies, though municipal utilities also play a strong role in the local electricity and district-heating markets. The electricity market is dominated by Fortum, whose market share in Finland’s electricity market is close to 27 percent. Fortum Oyj is a publicly listed energy company, in which the state holds 50.8% of shares. Pohjolan Voima Oy (PVO) is the second biggest Finnish energy company. The Finnish transmission grid is owned by Fingrid, another state-owned company. Distribution companies are owned by municipalities or private companies. The DSOs with largest market share are Fortum with a market share of 19 % and Vattenfall with a market share of 12 %. | Fortum; PVO | Fingrid | Fortum; Vattenfall; municipalities | Fortum |
| Norway | The Norwegian power sector comprises a large number of mostly publicly owned participants. Around 90% of generating capacity is in public ownership, with local municipalities and county authorities alone owning just over half. The state-owned utility, Statkraft, is the largest generator. There are more than 160 small distribution system operators (DSOs) in Norway, most of them publicly owned. The dominant supplier within a network area is most often a vertically integrated supplier or a supplier within the same corporation as the DSO. | Statkraft | Statnett | regional and local companies | regional and local companies |
| Sweden | The only major energy company owned by the Swedish state is Vattenfall, which is one of several major players in the Swedish electricity market. Most of the small local electricity distribution companies and four gas distributors are owned by municipalities. Three companies - Vattenfall, Fortum (majority-owned by the Finnish government), and E.ON Sverige - generate the bulk of power in Sweden, own most of the distribution assets and account for around half of retail sales. The E.ON and Vattenfall groups have several DSO areas. The market share for the three dominant companies is 51,4 % (E.ON 19,0 %, Fortum and Vattenfall 16,2 % each). The state owned utility Svenska Kraftnät is the Transmission System Operator (TSO) for the electricity market. | Vattenfall; Fortum; E.ON Sverige | Svenska Kraftnät | Municipalities; Vattenfall; Fortum; E.ON Sverige | Vattenfall; Fortum; E.ON Sverige |
| *Compiled by the author from various sources, primarily OECD Factsheets (2015) and CMS Law e-guides (data from 2013/2014)* | | | | | |

Table 5 - Government ownership across different segments of electricity sector

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Country | Percentage of government ownership of the largest company active in electricity… | | | |
|  | **Generation** | **Transmission** | **Distribution** | **Retail** |
| Austria | 51 | 51 | 51 | 51 |
| Belgium | 0 | 45.4 | 79 | 0 |
| Germany | 0 | 0 | 0 | 0 |
| Luxembourg | 7.5 | 57.3 | 57.3 | 25.4 |
| Netherlands | 0 | 100 | 100 | 33 |
| Bulgaria | 60 | 100 | 0 | 0 |
| Czech Republic | 69.8 | 100 | 69.8 | 69.8 |
| Hungary | 99.9 | 100 | 0 | 0 |
| Poland | 61.9 | 100 | 40.5 | 40.5 |
| Romania | 80 | 74 | 0 | 0 |
| Slovak Republic | 34 | 100 | 51 | 51 |
| Croatia | 100 | 100 | 100 | 100 |
| Cyprus | 100 | 100 | 100 | 100 |
| Estonia | 100 | 100 | 100 | 100 |
| Ireland | 95 | 100 | 95 | 95 |
| Latvia | 100 | 100 | 100 | 100 |
| Lithuania | 96.1 | 97.5 | 82.6 | 82.6 |
| Malta | 100 | 100 | 100 | 100 |
| Slovenia | 100 | 100 | 100 | 50 |
| United Kingdom | 0 | 0 | 0 | 0 |
| France | 84.4 | 84.4 | 84.4 | 84.4 |
| Greece | 51 | 51 | 51 | 51 |
| Italy | 31.2 | 29.9 | 31.2 | 31.2 |
| Portugal | 0 | 10.3 | 0 | 0 |
| Spain | 0 | 20 | 0 | 0 |
| Denmark | 80 | 100 | 80 | 80 |
| Finland | 50.8 | 53.1 | 50.8 | 50.8 |
| Norway | 100 | 100 | 0 | 100 |
| Sweden | 100 | 100 | 100 | 100 |
| *OECD Product Market Regulation Indicators - http://www.oecd.org/eco/growth/indicatorsofproductmarketregulationhomepage.htm#indicators* | | | | |

Table 6 - Additional models controlling for the extent of market liberalization on regulators' ties

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | (1) | (2) | (3) | (4) | |
|  |  |  |  |  | |
| Network density | -4.621\*\*\* | -4.738\*\*\* | -4.584\*\*\* | -4.842\*\*\* | |
|  | (0.392) | (0.412) | (0.382) | (0.384) | |
|  | |  |  |  | |
| Homophily according to the extent of liberalization  Government ownership in: | | | | | |
|  | | | | | |
| Electricity distribution | -0.220 |  |  | |  |
|  | (0.136) |  |  | |  |
|  |  |  |  | |  |
| Electricity transmission | -0.065 |  |  | |  |
|  | (0.105) |  |  | |  |
|  |  |  |  | |  |
| Electricity generation | -0.196 |  |  | |  |
|  | (0.128) |  |  | |  |
|  |  |  |  | |  |
| Electricity retail | 0.167 |  |  | |  |
|  | (0.152) |  |  | |  |
|  |  |  |  | |  |
| Gas distribution |  | 0.072 |  | |  |
|  |  | (0.104) |  | |  |
|  |  |  |  | |  |
| Gas transmission |  | -0.137 |  | |  |
|  |  | (0.129) |  | |  |
|  |  |  |  | |  |
| Gas production |  | -0.157 |  | |  |
|  |  | (0.155) |  | |  |
|  |  |  |  | |  |
| Gas retail |  | 0.139 |  | |  |
|  |  | (0.173) |  | |  |
|  |  |  |  | |  |
| Market share of largest electricity generator |  |  |  | | 0.044 |
|  |  |  |  | | (0.119) |
|  |  |  |  | |  |
| Liberalization and incoming ties  Government ownership in: | | | | | |
|  | | | | | |
| Gas distribution |  |  | 0.182 | |  |
|  |  |  | (0.172) | |  |
|  |  |  |  | |  |
| Gas transmission |  |  | -0.053 | |  |
|  |  |  | (0.151) | |  |
|  |  |  |  | |  |
| Gas production |  |  | -0.366\* | |  |
|  |  |  | (0.205) | |  |
|  |  |  |  | |  |
| Gas retail |  |  | 0.010 | |  |
|  |  |  | (0.235) | |  |
|  |  |  |  | |  |
| Electricity distribution |  |  | -0.412\*\* | |  |
|  |  |  | (0.194) | |  |
|  |  |  |  | |  |
| Electricity transmission |  |  | -0.080 | |  |
|  |  |  | (0.145) | |  |
|  |  |  |  | |  |
| Electricity generation |  |  | -0.097 | |  |
|  |  |  | (0.186) | |  |
|  |  |  |  | |  |
| Electricity retail |  |  | 0.460\* | |  |
|  |  |  | (0.236) | |  |
|  |  |  |  | |  |
| Market share of largest electricity generator |  |  |  | | -0.112 |
|  |  |  |  | | (0.118) |
|  |  |  |  | |  |
|  |  |  |  | |  |
| Controls |  |  |  | |  |
| Co-membership in Regional Initiatives for Electricity | 0.476\*\*\* | 0.438\*\*\* | 0.614\*\*\* | | 0.447\*\*\* |
|  | (0.167) | (0.167) | (0.203) | | (0.166) |
|  |  |  |  | |  |
| Co-membership in Regional Initiatives for Gas | 0.142 | 0.136 | 0.261 | | 0.152 |
|  | (0.179) | (0.182) | (0.209) | | (0.182) |
|  |  |  |  | |  |
| Cross border electricity flows | 0.712\*\*\* | 0.716\*\*\* | 0.693\*\*\* | | 0.728\*\*\* |
|  | (0.174) | (0.175) | (0.203) | | (0.168) |
|  |  |  |  | |  |
| Cross border gas flows | 0.027 | 0.010 | -0.046 | | -0.015 |
|  | (0.090) | (0.090) | (0.097) | | (0.089) |
|  |  |  |  | |  |
| *Endogenous dependencies:* |  |  |  | |  |
| Reciprocity | 2.092\*\*\* | 2.196\*\*\* | 2.253\*\*\* | | 2.229\*\*\* |
|  | (0.364) | (0.360) | (0.366) | | (0.357) |
|  |  |  |  | |  |
| Activity | 3.790\*\* | 3.989\*\*\* | 3.601\*\* | | 4.127\*\* |
|  | (1.639) | (1.521) | (1.582) | | (1.672) |
|  |  |  |  | |  |
| Shared partners | 0.023 | 0.011 | -0.015 | | 0.006 |
|  | (0.032) | (0.034) | (0.035) | | (0.032) |
|  |  |  |  | |  |
| Transitivity | 1.191\*\*\* | 1.154\*\*\* | 1.032\*\*\* | | 1.131\*\*\* |
|  | (0.198) | (0.193) | (0.196) | | (0.191) |
|  |  |  |  | |  |
| Akaike Inf. Crit. | 501.039 | 506.378 | 505.162 | | 504.978 |
| Bayesian Inf. Crit. | 562.132 | 567.472 | 585.054 | | 561.372 |
| *Note:* | \*p<0.1; \*\*p<0.05; \*\*\*p<0.01 | | | | |