A comparison of the performance and efficiency of public- and privately-owned energy networks

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Executive Summary

SSE plc commissioned NERA Economic Consulting to consider the comparative effect of public and private ownership on cost efficiency and customer service performance in the electricity supply industry (ESI), with a focus on electricity networks.

We have reviewed academic papers that examine the performance of UK energy networks since privatisation in the early 1990s. The body of evidence includes studies published from the mid-to-late 1990s, i.e. we review 25 years or so of UK focussed research. We also review reports commissioned by UK economic regulators over this period. In addition, we have examined international evidence, with a particular focus on Australia and German energy networks. The reasons for focussing on these countries is that both have a mix of public and private ownership models which facilitates comparison, and their respective regulators publish comparative performance data.

The main conclusions we draw from our review of the evidence are:

1. The performance of electricity networks depends on a wide range of factors, but private ownership is associated with better outcomes for customers

There are numerous factors that influence the performance of electricity networks, of which the most notable is the existence of independent economic regulation and a strong institutional framework to promote cost efficiency and high quality of service. Other determinants include structural reforms such as unbundling and liberalisation, as well as the specific geographical and operating characteristics of each network. However, in the majority of cases, we find that privately-owned networks are more efficient and result in better outcomes relative to publicly-owned models.

2. The evidence is clear that privately-owned networks have lower costs and deliver higher customer service standards than their public counterparts

The evidence shows that in the UK, electricity networks have considerably reduced operating costs, increased investment levels, and improved service quality in the decades following privatisation.

For example, UK electricity distribution networks’ operating expenditure per customer declined by around 5 per cent per year from 1990 to 2016 in real terms, and is expected to continue to fall over the next five years.1 Over the same period, electricity distribution networks’ reduced the average number of interruptions to electricity customers from 122.6 to 45.9 per year, and the average time lost to power outages from 228.6 to 35.7 minutes per year.

Academic studies conclusively show that the divestiture of public ownership in the UK ESI resulted in substantial productivity growth, reflecting improvements in factors such as labour efficiency and technological innovation.2 These findings are supported by a recent study commissioned by Ofgem, which found that total factor productivity (TFP) improved by 34

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1 Ofgem (18 December 2018), RIIO-2 Sector Specific Methodology Consultation, Electricity Distribution Data.


per cent from 1990/91 to 2016/17 in electricity distribution in the UK. Similarly, a recent European Commission study found that across the EU-28, state-owned enterprises in the ESI on average have higher opex costs than privately-owned companies.

In Australia, there is clear evidence that privately-run networks are more efficient and better managed than their state-owned counterparts. Since privatisation, private networks’ costs have fallen significantly, resulting in a 50 per cent reduction in distribution charges to domestic customers in real terms. A national enquiry into electricity networks’ performance recently recommended that state governments privatise their remaining public network businesses.

Additionally, micro-economic studies from across the UK, US and other OECD nations show that privatisation is associated with lower consumer prices for electricity. Equally, macro-economic studies find that the privatisation of utilities companies is generally followed by higher GDP growth and job creation.

3. Under partial or complete state ownership there is greater variability in outcomes and a higher likelihood of poor cost and customer service performance

The evidence from Australia and Germany, two countries that have implemented ownership reforms in their electricity sectors, demonstrates that partial or complete state ownership results in a wider variation in performance levels and a higher probability of underperformance. In Australia, publicly-owned networks have consistently underperformed against privately-owned comparators at the state level over the last ten years. The evidence also shows that the worst levels of customer service performance are associated with public ownership, and the cost performance of public networks is almost universally poorer.

In Germany, the data of the energy regulator and companies shows that re-municipalisation in Germany over the last 10 years has not resulted in improvements in price and performance. As with Australia, the poorest efficiency service quality performance is associated with public ownership. The change of ownership back to public hands has exposed tax-payers to significant business and investment risk without a commensurate improvement in outcomes for customers.

4. There is no evidence to support a return to public ownership of UK networks would be in the interest of consumers

Our review indicates that there is no evidence to show that a return to public ownership of UK energy networks is in the interests of the consumer or of the UK public. There has been substantive and continued improvement in cost and customer service performance in the period since privatisation. The UK ESI has tended to outperform publicly owned models. The evidence shows that the poorest cost and customer service levels are associated with public sector provision. If the objective is an electricity system that delivers enhanced services for customers and investment to deliver a decarbonised energy sector in the most

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4 European Commission (2016a), Appendix 2- Econometric Results, Table II A2.1, p.43.


6 AER (2018), Annual Benchmark Report, figure 15, p.32.
efficient way possible, the evidence clearly shows that the objective is most likely to be achieved through private provision subject to independent economic regulation.

By contrast, a policy of re-nationalisation in the UK will increase costs and result in poorer levels of service for consumers relative to the current system of private ownership.
1. Introduction

SSE plc commissioned NERA Economic Consulting to analyse the impact of private ownership on economic performance in the electricity supply industry (ESI), with a focus on electricity networks.

For this report, we have reviewed the relevant academic literature on the impact of private ownership and analysed historical performance data for UK and international electricity networks. We have contrasted the experience in the UK with evidence from other countries, in particular Australia and Germany, to provide a broader range of evidence that can inform the current debate around nationalisation in the UK.

To assess the impact of private ownership, we have analysed the historical performance of privately-owned electricity networks along the following dimensions:

- Costs and prices;
- Labour, capital, and total factor productivity;
- Investment levels;
- Service quality and the reliability of supply; and,
- The macro-economic effect of privatisation.

The remainder of this report is structured as follows:

- Section 2 presents our analysis of the performance of privately-owned UK electricity networks following privatisation;
- Section 3 reviews the international evidence on the relationship between private ownership and performance, with a focus on evidence from the European Union;
- Section 4 provides case studies from two countries that have recently implemented ownership reforms in the electricity sector, i.e. Australia and Germany; and,
- Section 5 concludes.

In Appendix A, we provide a summary of the key findings from the literature and studies we reviewed for this report.
2. UK Evidence on Efficiency, Service Quality, and Investment Shows that Private Ownership Beneficial for UK Consumers

In this section, we review the evidence on the performance of the UK electricity supply industry (ESI) following privatisation and contrast this to evidence from the EU and other countries around the world. The evidence shows that:

- **UK electricity networks have greatly reduced operating costs, increased investment levels, and improved service quality in the decades following privatisation**

We have reviewed the historical levels of operating and capital investment of UK electricity networks, as well as networks’ performance against key reliability measures.

Firstly, the data shows that since the time of privatisation, electricity distribution network operators (DNOs) in the UK have substantially improved their operating cost efficiency. Recent data shows that operating expenditure per customer has decreased at a rate of around 5 per cent per year in real terms (i.e. before allowing for the impact of general price inflation) over the period 1990 to 2016.

Secondly, the data shows that electricity DNOs have increased their levels of network investment per customer following privatisation. Over the past decade, these investments have been focused on reinforcing and modernising poorly performing legacy networks. More recently, investment has been focused on facilitating the growth of electricity generation in the form of Distributed Energy Resources such as wind and solar often owned by, or in partnership with, local communities.

Lastly, the evidence shows sustained improvements in reliability measures (i.e. customer interruptions and customer minutes lost), substantiating survey results indicating that customer satisfaction is at an all-time high.

- **Productivity levels increased substantially following privatisation of the UK ESI**

The existing body of academic research shows that labour productivity and total factor productivity markedly improved following the divestiture of public ownership in the UK ESI. In the years following privatisation, the UK outperformed comparable countries in terms of annual productivity growth in the electricity sector. This most likely reflects improvements in factors such as managerial efficiency and technological innovation.

2.1. Since privatisation, cost efficiency and quality has improved, and investment increased

In the 1980s and early 1990s, the UK government embarked on a programme of restructuring and privatisation of the electricity supply industry. The reform package had four key elements:

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7 Productivity is the relationship between the outputs of goods and services of a company and the input of resources used to produce them. An entity can be said to have become more productive if it is able to produce a greater level of outputs for a given level of inputs or, conversely, if it is able to produce the same level of outputs with fewer inputs.

1. **Privatisation**: the divestiture of publicly owned assets;

2. **Unbundling**: the separation of the networks from generation and supply;

3. **Price regulation for electricity networks**: oversight by an independent regulator who sets a price cap based on the RPI-X formula; and,

4. **Liberalisation/Market Opening**: the lifting of restrictions to market entry.

There has now been almost thirty years of private ownership in the ESI. During this time, the UK has seen substantial improvements in the standards of performance across a range of indicators in the sector. In this report, we focus on the performance of electricity distribution networks following privatisation. However, the report draws on evidence for the ESI as a whole where relevant.

It is important to note that the performance of the ESI in the UK since privatisation reflects all four elements of the reform package. Although the improvement in performance can be attributed to the change of ownership structure, the implementation of network unbundling, price regulation and market opening have also been supporting factors.

Figure 2.1 provides an overview of key measures of performance of UK electricity distribution network operators (DNOs) over recent decades, including operating expenditure per customer, capital investment per customer, and reliability measures (customer minutes lost and customer interruptions).

The data indicates that in the decades after privatisation, privately-owned electricity DNOs in the UK have substantively reduced operating expenditure per customer and improved the reliability of supply by continuously reducing customer minutes lost and customer interruptions. Investment levels increased considerably at the time of privatisation in 1990 and have increased steadily since, save for a reduction around the time of the global financial crisis. In the rest of this section we discuss the performance of each of these measures in more detail.
Figure 2.1: Overview of Performance of UK Electricity DNOs in the Decades After Privatisation

Operating Expenditure per Customer

Capital Investment per Customer

Customer Minutes Lost

Customer Interruptions

Note: Real (RPI-deflated) 2016-17 prices. Source: Ofgem (18 December 2018), RIIO-2 Sector Specific Methodology Consultation, Electricity Distribution Data.

Note: 2002-03 Prices. Source: Ofgem, ONS.

Note: Customer minutes lost refers to the total number of minutes for which customers have their supply interrupted in the relevant restoration stage. Source: Ofgem (18 December 2018), RIIO-2 Sector Specific Methodology Consultation, Electricity Distribution Data.

Note: Customer Interruptions is the total number of supply interruptions in the relevant restoration stage per customer recorded in a year. Source: Ofgem (18 December 2018), RIIO-2 Sector Specific Methodology Consultation, Electricity Distribution Data.
2.2. Operating cost performance has shown substantive improvement

Following privatisation, electricity DNOs in the UK achieved substantial reductions in operating expenditure (opex) per customer, as shown in the top left chart in Figure 2.1.

We analyse recent data published by Ofgem that provides a breakdown of capex and opex by network operators to find that, on average, operating costs per customer decreased by around 5 per cent per annum from 1990 to 2016. Opex per customer stood at £167 per customer in 2016 , compared to £61 per customer in 1990, in real terms.

Despite the substantial improvements in efficiency since privatisation and the increase in costs associated with improvements in system reliability, as discussed below, the DNOs expect continued improvements over the current price control. As shown in Figure 2.2, opex is also projected to decrease in the next five years. From 2017 to 2022, DNOs forecast opex per customer to fall by 0.4 per cent per annum on average (before inflation).

These findings are supported by earlier studies. A briefing paper commissioned by the UK Parliament in May 2018 states that since privatisation, the real unit operating expenditure (RUOE) has decreased by approximately 5.5 per cent per annum across distribution networks.9

These recent studies confirm the findings of the original studies that examined private network performance in the decade or so following privatisation. For example, an oft-cited independent study commissioned by a UK economic regulator in 2008 estimates that over the period 1990-2006, the RUOE of electricity DNOs decreased by 4 per cent per year on average.10 Similarly, a 2003 study commissioned by Ofgem estimates that UK electricity transmission experienced an average annual improvement in operating efficiency of 4.9 per cent over the period 1991-2002, with the equivalent estimate for electricity DNOs being as high as 7.7 per cent.11 The latter was considerably higher than for other countries surveyed by the study. For example, US and Norwegian DNOs, neither of which had experienced a similar level of private-sector ownership, achieved an average annual improvement in operating efficiency of only 0.5 per cent and 1.6 per cent, respectively, over the same period (1991-2002). These two comparators are chosen because their ESIs are the most similar to the UK in terms of size and structure.12

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9 "Network costs are now 17 per cent lower than at the time of privatisation (excluding inflation). Operating efficiency has increased, for example, real unit operating expenditure has fallen by approximately 5.5 per cent, per annum across the electricity distribution networks since privatisation.” Source: House of Commons Library (31 May 2018), Public Ownership of Industries and Services, Briefing Paper Number CBP8325, p.48, 49. Note: RUOE is a measure of operating performance calculated by dividing the real operating expenditure in a year by an appropriate output measure.

10 Oxera (April 2008) Network Rail’s scope for efficiency gains in CP4, published by ORR, Prepared for the Office of Rail Regulation, p.42, 43. For its calculation, Oxera relied on Ofgem publications including regulatory accounts, and adjusted for distorting events including the substantial transfer of costs from electricity distribution to supply in the third distribution price control review, and a change in accounting standards.


12 CEPA (November 2003), Productivity Improvements in Distribution Network Operators, p. 43, 44.
Figure 2.2: Opex is also Forecast to Decrease over RIIO-ED1

Note: Real RPI-deflated (2016-17 prices).
Source: Ofgem (18 December 2018), RIIO-2 Sector Specific Methodology Consultation, Electricity Distribution Data; Ofgem, RIIO-ED1 regulatory documents and supplementary files.

Figure 2.3: Estimates of Annual Efficiency Improvements Following Privatisation Reforms


Overall, the historical data shows that privately owned electricity DNOs in the UK have performed strongly on the dimensions of operational efficiency and expect continued improvements in cost performance. The improvements are not isolated to energy networks. There is similar evidence for the improved performance of UK electricity generation following privatisation. For example, Pollitt (1996) studies the comparative efficiency of
private versus publicly owned generation capacity and found a total costs advantage of 3 per cent for investor-owned capacity.\textsuperscript{13}

\section*{2.3. Capital investment has increased, and will continue to grow to help meet carbon objectives}

UK privately-owned electricity networks deliver considerably higher levels of capital investment than before privatisation. For example, a report commissioned by the UK Parliament in May 2018 states that:\textsuperscript{14}

\begin{quote}
\textit{“Capital investment in the electricity networks is higher on average than the period immediately prior to privatisation. The improvements this paid for have reduced power cuts by around 40 per cent since 2002. There are also record levels of customer satisfaction with local electricity and gas distribution networks.”}
\end{quote}

Indeed, historical data shows a substantial increase in total capital investment made by electricity DNOs after privatisation. In the period 1980-85 prior to privatisation, annual capital investment of UK electricity DNOs under public ownership was around £700 million or £30 per customer per year in 2003 prices.\textsuperscript{15} For the RIIO-ED1 period, 2015-2023, i.e. almost 30 years after privatisation, annual capital investment for private electricity DNOs will be around £1.2 billion, which is more than £40 per customer.\textsuperscript{16} This increased investment has been crucial to upgrading the network to meet growing demand, to improve reliability of supply, and more recently to facilitate the growth of embedded generation, including solar and wind energy, to supply renewable energy to customers’ homes.

Figure 2.4 shows capex per customer over the period 1980 to 2023 (in 2002/03 prices). In every regulatory period following privatisation, capex per customer has been higher than in the 10 years prior to privatisation.

\begin{footnotesize}
\begin{enumerate}
\item House of Commons Library (31 May 2018), Public Ownership of Industries and Services, Briefing Paper Number CBP8325, p.49.
\item Ofgem, RIIO-ED1 Regulatory Documents and Supplementary Files.
\end{enumerate}
\end{footnotesize}
Capital investment in electricity networks has focussed on meeting increased demand (i.e. an increase in the number of connections) and improving the reliability and safety of the networks (“non-load related”). In particular, over the past ten years or so DNOs have invested heavily in reinforcing and modernising networks, adopting innovative solutions for improving performance, such as the development of active network management (ANM) technologies to help alleviate network congestion and allow for smoother network operation in the future. Networks have also been investing significantly in greater storm resilience, to ensure electricity networks remain operative following major weather events.

The expected growth of low carbon and decentralised generation, along with the prospective growth in electric vehicles and the need to decarbonise heat means that DNOs are likely to play an increasing role in the heat and transport sectors. As a consequence, electricity demand on distribution networks is expected to grow significantly by 2050 in most energy scenarios. DNOs are investing to meet this challenge with an additional £12 billion of investment.
capital investment projected over the next 5 years,\textsuperscript{20} and much greater forecast expenditure to facilitate low carbon technologies over future price controls out to 2050.\textsuperscript{21}

\textbf{2.4. UK networks are ranked among leading performers on customer service measures}

In line with efficiency improvements and the increase in capex per customer, service quality and reliability levels have increased continuously over the last two decades, as shown in the bottom left and bottom right charts in Figure 2.1 and Figure 2.6 below.

Since privatisation in 1990, UK electricity DNOs have reduced the average number of customer interruptions (CI) from 122.6 to 45.9 per year, a 63 per cent reduction. Similarly, the average number of customer minutes lost (CML) has fallen from 228.6 to 35.7 minutes per year, an 84 per cent decrease.

Drawing on common measures of performance developed to facilitate pan-European benchmarking\textsuperscript{22}, UK electricity networks have consistently been ranked among the most reliable in Europe.\textsuperscript{23} The UK DNOs perform well above the EU average against both the system average interruption duration index (SAIDI, analogous to Ofgem’s “customer minutes lost”) and system average interruption frequency index (SAIFI, analogous to “customer interruptions”). In 2016, the UK had an average score of 0.54 and 46.5 for SAIFI and SAIDI respectively. The average for the equivalent measures across all EU-28 countries in the same year was 1.75 and 92.5, respectively.

Figure 2.5 shows the UK’s SAIDI and SAIFI performance from 2002 relative to the EU average. We note that there are a range of ownership structures in the ESI across EU countries, so the EU-28 average therefore comprises of both publicly and privately-owned networks, as well as systems of mixed ownership. The benchmarking report shows that the UK out-performs in comparison to countries with broadly similar economic and technological characteristics.

The indicators for service quality overwhelmingly show that companies have raised standards since privatisation. Current levels of customer satisfaction with local electricity and gas distribution networks are now the highest on record.\textsuperscript{24}

\textsuperscript{20} Ofgem (2017), RIIO Electricity Distribution Annual Report 2016-17, Supplementary Data File.


\textsuperscript{22} Council of European Energy Regulators, 6\textsuperscript{th} CEER Benchmarking Report on the Quality of Electricity and Gas Supply, 2016, p.36.

\textsuperscript{23} Council of European Energy Regulators, 6\textsuperscript{th} CEER Benchmarking Report on the Quality of Electricity and Gas Supply, 2016, p.36.

\textsuperscript{24} For example, in the most recent annual performance report, Ofgem states: “Customer service continues to improve, with all DNOs exceeding their customer service targets. The DNOs continue to actively engage with their stakeholders, and are working to address the needs of their vulnerable customers [...]”. See Ofgem (2019) Annual Report 2017/18, p.i. See also: UK Parliament (2018), Briefing Paper: Public Ownership of Industries and Services, House of Commons Library, Number CBP8325, 31 May 2018, p.49.
Figure 2.5: UK Electricity Networks Are Among the Best Performers in Europe (UK vs EU Average for SAIFI and SAIDI)

Note: Planned and unplanned SAIFI/SAIDI including exceptional events. EU countries included in average: Austria, Bulgaria, Croatia, Czech Republic, Denmark, Estonia, Finland, France, Germany, UK, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, the Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland.
UK Evidence on Efficiency, Service Quality, and Investment Shows that Private Ownership Beneficial for UK Consumers

Figure 2.6: Customer Minutes Lost (CML) & Customer Interruptions (CI) - Service Quality Measures, 1990 – 2017

Note: Customer Interruptions is the total number of supply interruptions in the relevant restoration stage per customer recorded in a year. Source: Ofgem (18 December 2018), RIIO-2 Sector Specific Methodology Consultation, Electricity Distribution Data.

Note: Customer minutes lost refers to the total number of minutes for which customers have their supply interrupted in the relevant restoration stage. Source: Ofgem (18 December 2018), RIIO-2 Sector Specific Methodology Consultation, Electricity Distribution Data.
2.5. Productivity performance is comparatively better

Prior to privatisation, the UK’s energy sector was characterised by sclerotic productivity growth. As a branch of the government, the Central Electricity Generating Board (CEGB) was susceptible to the demands of domestic interest groups that lobbied for preferential treatment in the industry. As a result, it developed substantial excess capacity following expensive technology choices that prioritised indigenous coal and nuclear power over other cheaper fuels.25

Historical data shows that productivity levels in the ESI increased following privatisation. A recent study commissioned by Ofgem found that total factor productivity (TFP, a measure of the level of resources or inputs to deliver products or outputs, e.g. electricity distributed) improved by 34 per cent from 1990/91 to 2016/17 in electricity distribution in the UK. This was supported by similar findings for other network industries. Over the same period, TFP improved by 13.5 per cent in gas distribution and 72 per cent in gas transmission. The study found that productivity in electricity transmission also improved once the improvements in quality were incorporated into the measure of output.26

Improvements in labour productivity contributed substantively to the improvement in TFP. Labour productivity more than doubled in the first five years after the reforms. As shown in Figure 2.7, the rate of growth increased from 2.5 to over 7 per cent from the 1980s to the 1990s, outstripping that of the US, France and Germany. At the time, the ESI was under full state ownership in France, while the US and Germany operated a system of mixed public and private ownership. This acceleration on productivity is particularly high relative to the 2 per cent norm achieved for aggregate GDP or the manufacturing sector in the 1990s.27 In a study that focused on electricity generation, Triebs & Pollitt (2017) find that privatisation also increased labour productivity by about 50 per cent in the UK.28

Similarly, studies that originally examined the impact of privatisation find that TFP surged in the ten year or so following reform. For example, O’Mahony and de Boer (2003), find that the UK utilities sector experienced a 3.45 per cent TFP growth from 1989-1999, almost twice the national average of 1.9 per cent for the period (see Figure 2.8).29 CEPA (2003) estimates that TFP growth for the UK DNOs between 1991-2001 was 4.2 per cent, over three times the economy-wide average of 1.3 per cent.30

28 Triebs, T. P and Pollitt M. G. (2017), Objectives and Incentives: Evidence from the Privatisation of Great Britain’s Power Plants, SSRN.
Furthermore, the Ofgem commissioned report on productivity in network industries argues that efficiency improvements have been held back in recent years by government environmental objectives. These have required energy networks to invest heavily for the addition of renewables and the promotion of energy efficiency, without any increased measured outputs.\textsuperscript{31}

\textbf{Figure 2.7: Labour Productivity Growth in Electricity Supply by Country}

Note: Labour productivity is measured by output divided by total number of workers. France ESI under state ownership in this period; US and Germany ESI operate under a system of mixed ownership. Source: O’Mahony and Vecchi (2001), NIESR.

\textbf{Figure 2.8: Total Factor Productivity Growth in the Electricity, Gas and Water Sectors by Country}

Note: France ESI under state ownership in this period; US and Germany ESI operate under a system of mixed ownership. Source: O’Mahony and De Boer (2003), NIESR.

\textsuperscript{31} Ajayi, V., Anaya, K. & M. Pollitt (2018), op. cit., p.2.
3. International Evidence

Since the time of privatisation in the UK, there has been a global trend towards private ownership in the electricity sector.32 We have therefore analysed evidence from other regions and countries that have liberalised their electricity sector. In general, the evidence shows that:

▪ **In the EU, private companies tend to be more cost efficient than state-owned enterprises**

The empirical evidence shows that across the EU-28, private energy firms tend to manage operating, capital and labour costs more efficiently than publicly owned counterparts in the ESI. In particular, a study by the European Commission shows that private generation, transmission, and distribution companies in the EU operate more cost efficiently than state-owned companies in the electricity sector. The effect is strongest for private transmission network operators and private generation companies, who perform considerably better on opex efficiency and return on capital than their state-owned comparators. The evidence from other studies shows that privately-owned companies in the European electricity sector utilise capital more efficiently.

▪ **Micro-economic studies show that privatisation reduces prices to consumers**

An analysis of the literature shows that, across the UK, US and other OECD nations, privatisation is associated with lower consumer prices. In the ten years following privatisation (1990-2000), real electricity prices in the UK fell by 22 per cent for domestic customers and 32 per cent for industrial customers. The evidence is similar for developed countries inside and outside the EU, although the UK has performed particularly well in this regard.

For developing countries, the literature shows that overall, privatisation has resulted in improved efficiency, investment, and quality of output, so long as reforms have been accompanied by effective, independent regulation.

▪ **Macro-economic studies show that privatisation boosts growth and consumer welfare**

Our review and analysis of the existing body of research shows that, across the board, academic studies find that privatisation is generally followed by higher GDP growth and job creation at a macro-economic level.

Looking specifically at the UK, studies find a total increase in economic welfare of 1.4 per cent, equivalent to around €17 billion, with most of the economic gains coming from the electricity and telecommunications industries, which saw the greatest reduction in prices and increase in productivity and account for over two thirds of all output across the network services considered.

▪ **The average time and cost to connect is lower for private companies, but effective independent regulation is key to ensuring positive outcomes**

The data from the World Bank shows that privately-owned electricity distribution companies connect clients to the grid at a faster rate and lower cost, on average, compared to publicly

owned distribution utilities. However, the data also indicates that effective independent regulation is crucial for ensuring that the private management of utilities companies results in positive outcomes for customers.

3.1. Historical Background

Internationally, there is a diverse mix of private and public ownership models in the ESI. For example, the integrated power utility in France, Électricité de France (EDF), was publicly owned until recently. In the US and in Germany, both private and public integrated utilities exist alongside one another. Overall, there has been an international trend towards privatisation of electricity networks following the implementation of reforms in the UK in the early 1990s.33

Figure 3.1 below shows the historical trend of the OECD Public Ownership and Market Regulation (PMR) index from 1975-2013. The PMR indicator broadly summarises the regulatory history of the reform process. It accounts for grid access for independent generators, liberalised wholesale and retail market, unbundling vertically integrated activities and divestiture of public electricity assets. As displayed, the UK reforms precede a general move towards privatisation and deregulation globally, with the OECD and EU average falling considerably from 1990 onwards. Accordingly, Australia and Germany both implemented reforms in the ESI in the late 1990s, as displayed by the sharp fall in their respective PMR index values. We provide case studies for these two countries in section 4 of this report.

Figure 3.1: OECD Public Ownership and Market Regulation Index in the ESI

<table>
<thead>
<tr>
<th>Year</th>
<th>OECD PMR Index</th>
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<td>2013</td>
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Note: Index scale of 0-6 from least to most public ownership and market regulation. Source: OECD.

The privatisation reforms in the UK were seen as a success and followed by other countries. For example, New Zealand, Australia, Argentina, and other countries restructured their electricity sectors by unbundling generation, transmission and supply sectors following the UK example. In Australia, the government relied on aspects of the UK experience when reforming its electricity networks.

Since the Single European Act of 1987, the European Commission has been committed to the liberalisation of all network industries. In 1997, the European Electricity Directive prescribed common rules for the progressive liberalisation of the national electricity markets within the EU, which was followed by a series of reform directives, including in 2003 and 2009, which were aimed at completing a European single market for electricity and gas.

The Commission’s stated aim is to increase the number of competing firms in each national market. This involves reducing barriers to entry and increasing the effective size of the market from the national level to across the EU. Over the last 30 years virtually all European countries have undertaken some kind of reform in their network industries, albeit with variation in terms of the scope and extent of privatisation. Private firms now represent 40 per cent of the energy industry in the EU in terms of revenues.

3.2. **In the EU, privately-owned networks are more efficient**

The European Commission conducted a review of performance in the energy sector in 2016, looking at how state-owned enterprises (SOEs) fare relative to private firms. It looked at companies in the EU-28 (including the UK) from 2008-2013, considering both majority and minority public companies, to establish the effect that state-ownership has on costs. It considered the following three measures:

- **Opex Ratio:** the ratio of operating expenditures over revenues, i.e. a proxy for operating efficiency;
- **Return on Capital Employed (ROCE):** companies’ profitability and the efficiency with which they use their capital. The higher the value of this indicator, the higher the profit companies generate for every euro of capital invested; and
- **The Staff Costs Ratio** (i.e. staff costs as a share of operating expenses): provides an indication of the labour-intensity of each company.

The findings of this study are summarised in Table 3.1 below. The percentages in the table were obtained through regression analysis and represent the total effect on the cost variables of a firm that is owned by the state compared to private ownership.

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Table 3.1: Effect of State Ownership on Costs and Investments in the ESI

<table>
<thead>
<tr>
<th>Sector</th>
<th>Opex Ratio</th>
<th>ROCE</th>
<th>Staff Cost Ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>Generation</td>
<td>8%</td>
<td>-2%</td>
<td>3%</td>
</tr>
<tr>
<td>Transmission</td>
<td>47%</td>
<td>-9%</td>
<td>11%</td>
</tr>
<tr>
<td>Distribution</td>
<td>Na.</td>
<td>Na.</td>
<td>4%</td>
</tr>
<tr>
<td>Retail</td>
<td>Na.</td>
<td>Na.</td>
<td>-1%</td>
</tr>
</tbody>
</table>

*Note: Figures reflect data from EU-28 countries over the period 2008-2013. Na. reported if regression results statistically insignificant at p<0.05. All other results are significant at p<0.01.*

*Source: European Commission (2016a), Appendix 2- Econometric Results, Table II A2.1, p.43.*

As shown in the table, SOEs generally have higher opex ratios, lower ROCEs and higher staff costs than privately-owned companies, except for the retail sector where private companies tend to be slightly less efficient with respect to staff cost. Most notably, government owned transmission networks were found to have an average opex ratio that is almost 50 per cent higher than for privately owned networks, indicating that private networks perform considerably better on operational efficiency. The studies also find that state-owned transmission networks have 9 per cent lower returns and 11 per cent higher staff cost ratios, on average.

For distribution networks, the studies find that the staff cost ratio is 4 per cent higher for state-owned networks than for private networks, indicating that private networks are more cost efficient. They do not find a significant difference with regard to the opex ratio and ROCE, indicating a more varied effect of private ownership in the EU as a whole compared to the UK for these networks.

Overall, this study provides strong evidence that private firms manage opex, capital, and labour costs more efficiently than publicly owned counterparts.

Ernst & Young (2006) also considers the effect of liberalisation on efficiency. In particular, the authors of this study examine the effect of privatisation on reserve margins in the EU. They define the reserve margin as the percentage of installed capacity in excess of peak demand over a year. They find evidence that private networks have lower reserve margins, reflecting a more efficient use of available capacity and improved sharing mechanisms between firms. They find no evidence that the reduction in reserve margins leads to lower reliability levels.38

Overall, the studies confirm that the evidence shows that private energy companies in the EU are more efficient than state-owned companies.

### 3.3. Microeconomic studies show that privatisation reduces prices

In the UK, electricity prices fell substantially following the reforms in 1990. In the ten years following privatisation (1990-2000), real electricity prices fell by 22 per cent for domestic customers and 32 per cent for industrial customers.39 Subsequently, following the introduction of full retail competition in 1999, industrial prices fell again sharply, especially

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39 OECD (2002), *Regulatory Reform in Gas and Electricity and the Professions*, *Regulatory Reform in the UK*, p.22.
for small consumers.\textsuperscript{40} From the period between 1995-2004, UK industrial prices fell by more than any other European country.\textsuperscript{41}

In terms of distributional consequences, EY (2006) find that privatisation has led to energy costs representing a smaller proportion of overall income in the UK, especially for the most vulnerable domestic consumer categories. They estimate that the average share of expenditure on energy fell by around 20 per cent from 1997-2002, in large part driven by liberalisation policies.\textsuperscript{42}

The empirical evidence from studies conducted around the world suggests that this phenomenon is not exclusive to the UK, but rather that it is widespread internationally. In Europe, a recent paper that uses panel-data from 28 countries found the liberalisation of the ESI significantly reduced electricity prices. The authors estimate that over the period 2000-2014, market opening lowered prices by between 10.6 and 36.7 per cent.\textsuperscript{43} Similarly, Ernst & Young (2006) find that countries that liberalised electricity markets have lower prices. They measure the correlation between prices and the level of liberalisation, proxied by the degree of market opening and market concentration. Using data from the EU-15 from 1990 to 2003, they estimate that a 1 per cent increase in liberalisation associated with fall in electricity price of €0.21-0.25. Full liberalisation reduces electricity prices by around €0.1 per kWh.\textsuperscript{44}

The same trend can also be seen outside of Europe. For example, in the US, Joskow (2006) finds that competitive wholesale and retail markets reduced prices relative to state ownership by 5–10 per cent for residential customers and 5 per cent for industrial customers.\textsuperscript{45} In a later study that analyses data from 1986-1996 for 19 OCED countries, Steiner (2011) finds that market liberalisation in the ESI is associated with improved efficiency and reduced consumer prices.\textsuperscript{46}

The privatisation of utilities companies has also been a prominent topic of debate in developing countries in recent decades. Numerous countries have implemented major reforms as a means to increase access to services across the population and stimulate economic growth. As a result, there is a rich academic literature on the subject, which finds that overall privatisation has resulted in improved efficiency, investment and quality of output, so long as reforms have been accompanied by effective, independent regulation.

In a study looking at the effect of private sector participation in the electricity sector in developing countries over more than a decade, Gassner et. al. (2009) find that private ownership significantly increases productivity. They analyse data from a sample of over

\textsuperscript{40} Thomas, S. (2006), Recent Evidence on the Impact of Electricity Liberalisation on Consumer Prices, Public Services International Research Unit, p.8.

\textsuperscript{41} KEMA (2005), Review of European Electricity Prices, Report for Union of the Electricity Industry – EURELECTRIC.


\textsuperscript{44} Ernst & Young (2006), op. cit.


1200 utilities companies in 71 countries to show that firms with private sector involvement largely outperform a set of comparable state-owned companies, especially in terms of improved labour productivity, operational performance and investment levels. Comparing average annual performances prior and post private participation for electricity distribution companies, they find that private sector involvement led to:  

- a 29 per cent increase in residential connections per worker,
- a 32 per cent increase in electricity sold per worker,
- a 45 per cent increase in bill collection rates,
- a 11 per cent reduction in distribution losses, and
- a 54 per cent increase in capex per worker.

Thus, the evidence from developing countries supports the conclusions from the developed countries discussed above. Privatisation appears to generally improve performance in the ESI, regardless of the level of development of a country.

3.4. Macroeconomic studies show that privatisation boosts growth

There are also studies that discuss the overall economic effects of public divestitures in the ESI. This research considers the total social gains or losses from privatisation, which equates to more than the just the sum of the different effects on the electricity market. Indeed, to the extent that privatised industries interact with other sectors of the economy, reforms possess the potential for large spill-over effects to the rest of the economy. Market opening induces competition and more efficient production in network industries, giving rise to lower prices and greater choice. In turn, this reduces operating costs in all industries using network services, stimulating overall demand, boosting growth and creating new jobs.

In a report for the European Commission, Copenhagen Economics (2005) quantify the effects of the liberalisation of public utilities on the EU economy. They find that the reforms boosted EU GDP in total by 2 per cent through a combination of lower prices and costs. This equates to a monetary value of €98 billion and is estimated to have given rise to additional employment corresponding to about 500,000 jobs. They conclude that:

"Those members (of the EU) who opened markets more and who started early have gained the most."

The report finds that the UK was the country that liberalised network markets the most during this period. Looking specifically at the UK, they find a total increase in economic welfare of 1.4 per cent, equivalent to roughly €17 billion. Their study finds that the economic gains come predominantly from the electricity and telecommunications industries, which saw the greatest reduction in prices and increase in productivity and account for over two-thirds of all output across the network services considered.

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Other studies that focus on the UK or other countries find similar results. In general, they show that privatisation is strongly associated with welfare and output gains across the entire economy. Some of these gains have been considerable. For example, Toba (2003) estimates that the liberalisation of the electricity generation sector in the Philippines produced a one-off gain equivalent to around 10 per cent of GDP. Mota (2003) finds that the privatisation and incentive regulation of Brazilian electricity distribution produced a one-off gain of more than 2 per cent of GDP.

We summarise the findings from macro-economic research in the academic literature in Table 3.2 below. We provide a summary of the key findings from all the studies we have reviewed for this report in Appendix A.

Table 3.2: Summary of Cost-Benefit Analysis Studies of ESI Liberalisation Reforms

<table>
<thead>
<tr>
<th>Study</th>
<th>Reform &amp; Company/ Year/ Country</th>
<th>Overall Welfare</th>
</tr>
</thead>
<tbody>
<tr>
<td>Galal et al. (1994)</td>
<td>Privatisation of CHILGENER—generation and transmission/1981–1986/Chile</td>
<td>Permanent gain of 2.1% of sales</td>
</tr>
<tr>
<td>Galal et al. (1994)</td>
<td>Privatisation of ENERSIS—distribution/1986/Chile</td>
<td>Permanent gain of 5% of sales</td>
</tr>
<tr>
<td>Newbery &amp; Pollitt (1997)</td>
<td>Privatisation and restructuring of CEGB—generation and transmission monopoly/1990/UK</td>
<td>Permanent gain of 6% of turnover</td>
</tr>
<tr>
<td>Domah &amp; Pollitt (2001)</td>
<td>Privatisation of 12 Regional Electricity Distribution Companies/ 1990/UK</td>
<td>Permanent gain of 9% of turnover</td>
</tr>
<tr>
<td>Toba (2002)</td>
<td>Privatisation of distribution company—Meralco/1986/Philippines</td>
<td>Permanent gain of 6.5% of sales</td>
</tr>
<tr>
<td>Mota (2003)</td>
<td>Privatisation of distribution companies/1995–2000/Brazil</td>
<td>One off gain equal to 2.5% of GDP</td>
</tr>
<tr>
<td>Copenhagen Economics (2005)</td>
<td>Liberalisation of Utilities Sectors/1990-2005/EU</td>
<td>1.9% boost to EU consumer welfare and 1.4% to UK consumer welfare</td>
</tr>
<tr>
<td>Toba (2007)</td>
<td>Introduction of PPAs with IPPs by incumbent generator, NPC/1990–93/Philippines</td>
<td>One off gain of around 13% of GDP</td>
</tr>
<tr>
<td>Anaya (2010)</td>
<td>Privatisation of 2 distribution and retail companies/1994/Peru</td>
<td>Permanent gain of 27% of costs</td>
</tr>
</tbody>
</table>

3.5. **World Bank Data shows that the Time and Cost to Connect is Lower for Private Firms**

The World Bank ‘Doing Business’ database provides information on the average time and cost to connect customers to an electricity supply for public and private electricity distribution utilities around the world.

The database covers over 200 cities, of which 71 per cent have electricity distribution utilities that are majority-owned by the public sector, while 29 per cent have privately-owned distribution utilities. Private electricity utilities are concentrated in high and middle-income countries, reflecting the fact that privatisation typically occurs in wealthier societies, where efficient stock markets enable firms to issue public debt. Private utilities remain rare at the regional level in Sub-Saharan Africa, East Asia and Pacific and Middle East and North Africa. In contrast, Europe and Central Asia and the OECD high-income group have a more balanced share of private and public distribution companies.

As we show in Figure 3.2 and Figure 3.3 below, privately-owned companies connect clients to the grid at a faster rate and lower cost, on average, compared to publicly owned distribution companies.50

Crucially, the data indicates that effective independent regulation is central to ensuring that the private management of utilities companies results in positive outcomes for customers. For electricity distribution, the existence of an electricity sector regulator – either at the state or federal level – is significantly associated with lower outages, suggesting that when there is an independent body monitoring utility performance on reliability, power outages are less likely to occur.51

With effective regulatory frameworks in place, private firms generally perform better than their public counterparts. Overall, private firms tend to be more proactive and innovative in improving service quality. The ‘Doing Business’ data shows that since 2010, 47 percent of private utilities have implemented one or more reforms aimed at improving connections, compared to 39 percent of public utilities.52

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51 Bortolotti et al. (2003), Section 4.

52 Bortolotti et al. (2003), Section 3.
Figure 3.2: Average Cost to Connect for Public vs. Private Electricity Distribution Utilities


Figure 3.3: Average Time to Connect for Public vs. Private Electricity Distribution Utilities

4. Case Studies

To add an international perspective to the current debate around the nationalisation of energy networks in the UK, we present two case studies on countries that have implemented ownership reforms in their electricity sectors: Australia and Germany. We find that:

- **In Australia, electricity networks are more efficient under private ownership**

In Australia, there is clear evidence that privately-run networks are more efficient and better managed than their state-owned counterparts. They have performed better in terms of costs, productivity and reliability over recent years. A national enquiry into electricity networks’ performance in 2013 recommended that state and territory governments privatise their remaining public network businesses.

- **In Germany, private ownership in the energy sector is associated with high levels of efficiency and customer service**

The evidence shows that re-municipalisation in recent years in Germany has not resulted in improvements in price and performance. While certain publicly owned companies have achieved the same level of performance as private firms’ in terms of efficiency and service quality, there is far greater probability of consumers’ facing high cost and poor performance under public ownership. In addition, the change of ownership back to public hands has exposed customers and tax-payers to significant business and investment risk.

4.1. Electricity networks in Australia are more efficient under private ownership

A relevant country to look at when considering the effect of privatisation in the ESI is Australia. Australia’s electricity network is currently operated under mixed ownership, with some networks owned by the state and others privatised, depending on the region. The general historical trend has been towards privatisation, with Victoria and South Australia having sold all networks assets under state ownership in the 1990s. New South Wales is currently also in the process of privatising its distribution sector, having recently done the same in transmission.\(^{53}\) At the time of this report, Queensland, Tasmania, Northern Territories and Western Australia maintain public ownership, though there are strong calls for extending the policy to networks in these states as well.

This mixed ownership structure provides a good body of evidence on which to compare performance. It provides evidence on outcomes for companies following privatisation, which we can measure against two counterfactual scenarios: (1) performance in the same state before and after privatisation, and (2) performance between states that pursued different policies during the same period.

The issue of ownership has been prevalent in public discourse in recent years as states continue to debate privatising their remaining assets. As such, it has been the subject of significant research from regulators and policymakers. Most notably, a major review of the sector by the government’s Productivity Commission in 2013 came out strongly in favour of private ownership, concluding that private networks were more efficient than the remaining

state-owned ones. The Commission recommended that state and territory governments privatise their remaining public network businesses, stating:

“The rationale for government ownership of network businesses no longer holds. State-owned status is ill-suited to the current incentive regulatory regime.”54

The Commission assessed several factors in this analysis including price, opex per kilometre, customers per employee and safety measures (e.g. fire starts). They found that, since privatisation, costs have fallen significantly in privatised networks and distribution charges to domestic customers have been reduced by 50 per cent in real terms. Accordingly, since the time of these reforms, electricity bills have increased less in the privatised states of Victoria and South Australia than over the same period in the non-privatised states of NSW and Queensland.

Further, private companies were found to have broadly delivered on the requirements placed on them by regulators to benefit consumers, including improvements in the quality and security of supply.55 Over the 10-year period from 2001 to 2010, Victoria and South Australia (states with privatised networks) had the lowest SAIDI among the regions, while South Australia had the lowest SAIFI (and Victoria the third lowest). Over the last five years from 2012-2016, the networks with the worst levels of reliability have been state-owned. In Figure 4.1 below, we show the average customer minutes lost per customer and average number of interruptions per customer by electricity distribution network service provider (DNSP) in Australia. Public-owned companies are shown in blue and private firms in orange. It is clear from this data that private DNSPs have performed better than state-owned comparators.56

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56 ACT (ActewAGL) is a public-private partnership set up as a joint venture between the Government of the Australian Capital Territory and AGL Energy Ltd in 2000. The state currently owns 50 per cent of the company via Icon Water Ltd, a water and waste-water public utility company.
Conversely, the Commission found that state-owned networks suffered from poor management and had ineffective cost controls. They argue that governments have conflicting objectives to network businesses, so incentive regulation would improve under private ownership, thereby reinforcing efficiency improvements. They conclude that network operators perform better without the political overlay of a government shareholder. The private sector is found to be more adept at reducing costs and running business efficiently than the state.

Following this report, the 2016 Australian Infrastructure plan, which sets out the government’s long-term investment plan, echoed the conclusions of the Productivity Commission. It summarises:

“Domestic and international evidence shows that cost-minimising, profit-maximising ownership structures are the best means to deliver efficient and customer responsive infrastructure. Private owners have the best incentives to respond to these drivers when compared to public ownership.”

The Australian Energy Regulator (AER) conducts annual benchmarking studies on the electricity retail market, allowing comparison between network operators. In Figure 4.2 below, we show total factor productivity across distribution network service providers in Australia. In the chart, dotted lines show publicly owned networks whilst solid lines show private networks. It is clear from the data between 2006-2016 that private networks consistently outperform state-owned comparators in terms of productivity.

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Figure 4.2: TFP by DNSP in Australia
(public-owned = dashed lines, private-owned = solid lines)

Note: Calculated using the multilateral total factor productivity technique. ACT power networks are owned through a public/private joint venture.
Source: AER (2018), Annual Benchmark Report, figure 15, p.32.

Relatedly, we see in Figure 4.3 below that the same finding holds for costs per customer. In this chart, we show total costs per customer against customer densities, to adjust for the effect of long and costly network lengths in rural areas. Again, publicly-owned companies are shown in blue and private firms in orange. As displayed, the private DNSPs with low customer density operate at lower cost per customer than equivalent state-owned networks. For example, Ausgrid (AGD) and ActewAGL (ACT) have higher total costs per customer than Ausnet (AND) or Powercor (PCR), which have significantly lower customer densities.
To summarise, in Australia there is clear evidence that privately-run networks are more efficient and well-managed than their state-owned counterparts. They perform better in terms of costs, productivity and reliability. As such, far from calling for nationalisation, the government’s productivity commission has called for extending privatisation.

4.2. Public ownership in the German energy sector is associated with lower efficiency

In Germany, after a wave of public divestitures of energy companies in the mid-1990s, numerous municipalities have since opted to bring energy distribution and supply back into public hands. This return to public ownership came about after the expiration of numerous network licenses, which provided municipalities with the opportunity to regain ownership over certain networks. The trend of re-municipalisation has seen communal energy companies almost double their share of total revenue in the sector from 2000-2010, measured as a proportion of GDP. The total number of municipal energy companies has also risen from 1100 in 2004 to almost 1500 in 2017. An illustrative example of this trend is the city of Hamburg, which re-purchased its electricity distribution networks from Vattenfall and E.ON in 2014.

According to the German Monopoly Commission, an independent advisory body to the German government, re-municipalisation was primarily driven by citizens’ groups

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campaigning for the decentralisation and nationalisation of utility companies. The stated goals of the process, according to the main stakeholder acting on behalf of German communal utilities, was to improve consumer welfare, network performance and municipalities’ financial positions. Similarly, a 2011 survey by the University of Leipzig found that besides political considerations (such as the general desire to regain municipal control), fiscal motives and consumer considerations are among the factors driving re-municipalisation. Accordingly, we assess three key justifications for the process of increased public ownership in Germany:

1. Performance (including efficiency and quality of service of the energy utility);
2. Fiscal benefits to public authorities; and,
3. Consumer advantages (in the form of lower prices).

### 4.2.1. Performance

The Bundesnetzagentur (BNetzA), the German network regulator, assesses the performance of energy network companies by looking at measures of cost efficiency and quality of service. To analyse the relationship between ownership structure and performance, we combine the regulator’s most recent benchmarking results in these two dimensions with publicly available information on the ownership structures of the fifty largest electricity and gas network operators in Germany.

The evidence shows that cost efficiency scores are generally higher for predominantly privately-owned companies. Figure 4.4 shows that greater shares of private ownership have led to higher efficiency scores. While several predominantly publicly-held operators score as well as their private counterparts, we find that publicly-held operators are far more likely to have very poor levels of cost efficiency. In general, there is a much wider variation in performance levels for firms with majority public ownership relative to those with majority private ownership.

This reduced cost efficiency might be a necessary trade-off of higher service quality. However, as shown in Figure 4.5, we find no discernible differences in service quality between predominantly privately and publicly-held companies, as measured by the System Average Interruption Duration Index (SAIDI). Indeed, as with cost performance, we find that publicly-owned networks are far more likely to perform poorly on reliability.

### 4.2.2. Fiscal Benefits

In the German context, it is widely understood that the expectation of a steady source of income for municipalities has been a key driver of the re-municipalisation process.  

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64 See e.g. Monopolkommission (2013), *op. cit.*, p.448,
However, as several observers note, this objective has not been realised due to the transfer of business risks from utility companies to municipalities’ balance sheets.

For example, in its annual monitoring report, the Court of Audit of the German state of Schleswig-Holstein states that the network operation by municipalities “in no way guarantees the sustainable generation of incomes for municipalities”. It notes that there are several business risks that are transferred to the public as a result of municipalisation. Specifically, it points to recent cases where public network takeovers have been accompanied by high purchasing costs and heavy resulting losses for municipal budgets that are yet to be recovered. As a result, the Court of Audit concludes that “re-municipalisation is generally not recommended”.

Besides unrecoverable purchasing costs, municipal power utilities in Germany are then further confronted with significant investment risks. A comprehensive study by the Handelsblatt Research Institute found that unexpected investments in grid expansion following the growing share of decentralised electricity production strained municipal budgets. Out of 270 German public distribution companies examined in the study in 2011 and 2012, more than one third of the operators made losses in at least one of the two years (negative net income before tax). Every fifth operator was found to have made losses in both years. A recent study by KPMG further found every fourth municipal utility in Germany to be in “alarming” financial shape.

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Figure 4.4: Efficiency Scores and Public Ownership Shares for the 50 Largest German DSOs

Notes: Sample includes the 50 largest gas DSOs and 50 largest electricity DSOs as measured by serviced area. Source: NERA-Analysis of Bundesnetzagentur data and company annual reports.

The BNetzA efficiency value aims at measuring the relative cost efficiency of a network operator. Using a Stochastic Frontier Model (SFM), the BNetzA identifies the expected relationship between expenditure and output measures based on all companies. It then identifies inefficiencies from the deviations between actual costs and the SFM-estimated costs.
4.2.3. Lower Prices

Besides the anticipated improvement of municipal budgets, the process of re-municipalisation in Germany also aimed to achieve lower prices for consumers. With the re-municipalisation of local electricity and gas distribution grids, municipal utilities usually aim to provide services along the entire value chain. While the process of energy market liberalisation in Europe mandates the separation of network operation from generation (unbundling), most municipalities are exempt from this rule due to their small size. Proponents of the process argue that new, integrated municipal providers can increase the intensity of retail price competition, especially in areas with few providers.69

This expectation has not materialised. Against the backdrop of increasing re-municipalisation, the Monopoly Commission has analysed energy prices, focusing particularly on public companies.70 It arrives at two conclusions:

1. Municipal providers do not provide the best tariffs for consumers but offer the cheapest tariff in only 1.5 per cent of postal code areas.
2. Municipal providers also do not provide generally favourable terms. Consumers can generally realise substantial savings when switching away from their default supplier (most commonly a municipal supplier) to a private supplier.

Thus, despite their vertically integrated structure that gives them a competitive advantage against other suppliers, municipally owned networks have failed to offer lower prices to

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69 See e.g. Monopolkommission (2013), op. cit., p.460 ff.
customers. The Commission concludes that there is no justification for the founding of new municipal energy providers based on potential consumer prices advantages.

To summarise, re-municipalisation in recent years in Germany has failed to achieve the anticipated improvements in price and performance. Our analysis shows that public ownership in the German energy sector is typically associated with lower efficiency scores, on average. Majority publicly-owned firms display a much wider variation in performance levels relative to privately-owned companies. The change of ownership back to public hands has also exposed tax-payers to substantial business and investment risks. In several cases, municipalities have suffered considerable financial losses following the take-overs of private assets for no discernible improvements in performance or service quality.
5. **Conclusion: Public Interest Best Served by Private Provision**

In this report, we have reviewed the empirical evidence on the relationship between ownership and performance in the ESI, with a focus on electricity networks. The question is a crucially important one, not least because the sector represents over 1 per cent of national gross domestic product, 100,000 jobs and more than £10bn in annual investment in the UK.\(^7\)

Our report analysed evidence from the academic literature, discussed recent data and presented two case studies from comparable countries. Our review of the evidence indicates that private ownership leads to better outcomes for consumers. In the UK and the rest of the world, private ownership of electricity networks has resulted in greater customer satisfaction and consumer welfare. On a macro-economic level, privatisation is associated with increased growth and productivity in the economy, leading to the generation of more jobs and higher incomes.

Studies that consider the effect of different ownership structures in the electricity sector find that privately-owned networks have better levels of cost efficiency and performance. Operating within a strong independent economic regulatory framework, private networks face strong incentives to minimise costs and improve customer service levels. In contrast, publicly-owned networks face competing political objectives, and have a poor record on cost and customer service performance with the financial risk passed-through to customers and/or taxpayers.

In Australia, state governments are now opting to privatise network assets after having observed significant improvements in performance from the private management of electricity networks. The government’s productivity commission highlighted the role of political interference and poor incentive structures in explaining the lacklustre productivity of state-owned networks over recent years.

In Germany, there has been a move towards the re-municipalisation of energy distribution and supply companies over the last few decades. However, municipally-owned firms are less efficient, on average, than their privately-owned counterparts. Public ownership has, on the other hand, exposed municipal governments to significant business risk and caused taxpayers to incur large investment costs.

In the case of the UK, the case for nationalisation has no evidence base. Conversely, cost performance has substantively improved since privatisation, with further improvements anticipated. At the same time, customer service interruptions have declined by around half. Capital investment has increased markedly to ensure a safer and more reliable network, with DNOs prepared to invest yet more to meet the challenges of de-carbonising energy and transport sectors.

If the objective is an electricity system that delivers enhanced services for customers and investment to deliver a decarbonised energy sector in the most efficient way possible, the evidence shows that the objective is most likely to be achieved through private provision subject to strong independent economic regulation.

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\(^7\) UK Department for Business, Energy & Industrial Strategy, UK Energy in Brief 2017, p.4-5.
## Appendix A. Summary of Studies on Ownership & Performance in the Electricity Supply Industry

<table>
<thead>
<tr>
<th>Study</th>
<th>Context/ Year/ Country</th>
<th>Outcome</th>
</tr>
</thead>
<tbody>
<tr>
<td>Triebs &amp; Pollitt (2017)</td>
<td>Privatisation of generation plants/ 1981-2004/ UK and US</td>
<td>50% increase in labour productivity following privatisation</td>
</tr>
<tr>
<td>European Commission (2016)</td>
<td>Performance of SOEs in energy sector/ 2008-2013/ EU-28 countries</td>
<td>State-ownership associated with higher opex ratio, ROCE and staff costs in ESI</td>
</tr>
<tr>
<td>Borghi et al. (2016)</td>
<td>Ownership in electricity distribution sector/ 2002-2009/ 16 EU countries</td>
<td>Public ownership associated with lower productivity levels, but mitigated by higher quality regulatory institutions</td>
</tr>
<tr>
<td>Asane-Otoo (2016)</td>
<td>Effect of liberalisation on emissions in ESI/ 1990-2012/ OECD countries</td>
<td>Increasing private participation in the electricity market decreases sectoral CO2 and NOx emission intensity</td>
</tr>
<tr>
<td>Boylan (2016)</td>
<td>Effect of ownership on performance in response to major storms for over 400 utilities companies/ 1999-2012/ US</td>
<td>Electricity consumption decreases more when the utility is municipally owned, no difference in power outage length/rate</td>
</tr>
<tr>
<td>Cullman &amp; Nieswand (2015)</td>
<td>Incentive based regulation for electricity DSOs/ 2006-2012/ Germany</td>
<td>No evidence of difference between public and private DSOs’ investment levels</td>
</tr>
<tr>
<td>Gao &amp; Van Biesebroeck (2011)</td>
<td>Privatisation of generation firms/ 1998-2007/ China</td>
<td>Privatised SOE plants decrease labour inputs 7% and material input 5% vs. control group; Privatisation increases labour and fuel productivity</td>
</tr>
<tr>
<td>Study</td>
<td>Context</td>
<td>Findings</td>
</tr>
<tr>
<td>-------</td>
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<tr>
<td>Gassner et al. (2009)</td>
<td>Privatisation of 1200 utilities companies/ 1990-2002/ 71 developing countries</td>
<td>11% reduction in distribution losses; 26% increase in residential connections per worker; 32% increase in electricity sold per worker; 54% increase in capex per worker</td>
</tr>
<tr>
<td>Pollitt (2009)</td>
<td>Liberalisation of ESI/ 1995-2005/ EU</td>
<td>Real prices fall for households, medium and large industries; Electricity sector TFP grows at 20% vs. economy wide average of 5%; No change in incidence of blackouts</td>
</tr>
<tr>
<td>Ernst &amp; Young (2006)</td>
<td>Privatisation of ESI/ 1995-2003/ EU-15</td>
<td>1% increase in liberalisation associated with fall in electricity price of 0.21-0.25 Euros; Reduction of reserve margin of 1.5% per year and higher utilisation rates; TFP increase of 5.9% per year</td>
</tr>
<tr>
<td>Copenhagen Economics (2005)</td>
<td>Liberalisation in network industries/ 1990-2005/ EU-15</td>
<td>7.6% reduction in electricity prices; 2.3% increase in TFP</td>
</tr>
<tr>
<td>KEMA (2005)</td>
<td>Study of electricity prices/ 1995-2004/ EU</td>
<td>UK industrial prices fall by 41%, the most in Europe</td>
</tr>
<tr>
<td>Author(s)</td>
<td>Description</td>
<td>Source</td>
</tr>
<tr>
<td>---------------------------</td>
<td>--------------------------------------------</td>
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</tr>
<tr>
<td>Fisher et al. (2003)</td>
<td>Privatisation of ESI/ 1988-2002/ Chile</td>
<td>T&amp;D losses dropped from 22% in 1982 to 5% in 2009; decrease in RUOE; Labour productivity rose from 1.4 GWh per employee in 1987 to 13.8 GWh per employee in 2002; 150% increase in installed capacity from 1988-2000</td>
</tr>
<tr>
<td>O'Mahony &amp; Vecchi (2001)</td>
<td>Privatisation of ESI/ 1960-1997/ UK</td>
<td>40% increase in labour productivity following privatisation</td>
</tr>
<tr>
<td>Newbery &amp; Pollitt (1997)</td>
<td>CEBG privatisation/ 1989-1996/ UK</td>
<td>5.5% decrease in RUOE following privatisation; Labour productivity doubles in 5 years following privatisation</td>
</tr>
</tbody>
</table>

Source: NERA Research.
Qualifications, assumptions and limiting conditions

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