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Reaching higher productivity growth in France and Germany

Sector case: Utilities

McKinsey
Global
Institute

with assistance from our Advisory Committee

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October 2002

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This document is an excerpt drawn from the report "Reaching higher productivity growth in France and Germany", published by the McKinsey Global Institute in October 2002.

The full report can be obtained from:

McKinsey Global Institute website:
http://www.mckinsey.com/knowledge/mgi/

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FOREWORD

For fifty years following the end of the Second World War, France and Germany continually narrowed the labor productivity gap with the US. In the mid-1990s, however, the trend reversed: France and Germany are no longer catching up. Weakening productivity performance should worry us given the current and projected demographic challenges: future living standards depend on high productivity growth. To develop effective solutions for dealing with these challenges, policy makers and business leaders in France and Germany need to base their decisions on a complete and nuanced understanding of the barriers to and drivers of higher productivity growth.

To contribute to such an understanding and derive actionable recommendations, the McKinsey Global Institute (MGI) performed an extensive in-depth analysis of the labor productivity performance of six sectors in France, Germany, and the US. The full report consists of an executive summary, seven chapters and an appendix. The first chapter, the Synthesis, provides an overview of our approach and conclusions, and can be read as a stand-alone summary of our work. The remaining chapters provide our case studies on Telecommunications, Retail banking, Automotive, Road freight, Retail trade and Utilities. Each of these cases has a brief summary in the beginning.

The MGI – McKinsey & Company's economic think tank – combines the firm’s business experience with the rigor of academic thinking. This document reflects active dialogue between industry experts, experts from premier research institutions, and our own specialists, who work closely with executives of leading French and German businesses. This project was conducted under the direction of Heino Faßbender, Diana Farrell, Eric Labaye, and Vincent Palmade. Thomas Kneip and Stephan Kriesel were responsible for the management of the project. We are very grateful to the companies and individuals who supported our research by agreeing to provide data about their operations through interviews and surveys.

In addition, our work benefited tremendously from in-depth discussions with the academic board: Olivier Blanchard from the Massachusetts Institute of Technology in Boston, Martin Baily from the Institute for International Economics in Washington DC, Hans Gersbach from the University of Heidelberg, Monika Schnitzer from the University of Munich, Jean Tirole from the University of Toulouse, and Robert M. Solow, Nobel laureate and the "godfather" of growth discussions – all of whom contributed significantly to interpreting the results of our research. McKinsey & Company has the privilege of serving many of the leading companies in France and Germany. Through this work, we have observed the huge potential that can be tapped in order to boost productivity performance. We hope that our report will help policy makers and business leaders unlock this potential by providing them with an objective and fact-based perspective.

Before concluding, we would like to emphasize that this work is independent and has not been commissioned or sponsored in any way by any business, government, or other institution.

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October 2002

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With more than 6,500 consultants deployed from 82 offices in 44 countries, McKinsey advises leading companies on strategic, operational, organizational, and technological issues. We work for the largest and most prestigious companies in each market we serve. In addition, we advise a diverse group of governments, public sector institutions, and nonprofit organizations on management and policy challenges. McKinsey has had a permanent office in both France and Germany since 1964, where we have served many of the top blue-chip companies in the areas of financial services, telecommunications, high tech, automotive, basic materials, and consumer goods.

THE MCKINSEY GLOBAL INSTITUTE

The McKinsey Global Institute (MGI) is the internal economic research think tank of McKinsey & Company. Founded in 1990 and based in Washington, DC, its mission is to offer insights into global economic issues of relevance to our clients and international leaders, and to research the key barriers to faster growth in the world economy.

The MGI's methodology is a combination of two distinct disciplines: economics and management. Both of these disciplines are concerned with economic growth, but neither is positioned to understand it fully. Economists have scant access to the real-life problems facing business managers, while managers often lack the time and incentive to look beyond their own situation to the larger issues of productivity in their industry or the economy as a whole. McKinsey's economic research remedies this situation by combining the academic rigor and breadth of economics with the deep and practical industry knowledge and management understanding we use in our daily work with clients. The MGI's research is founded on a unique collection of facts and microeconomic analyses that is beyond the reach of most academic and government-sponsored research. Our teams have conducted in-depth analyses of fourteen countries covering all continents, ranging from the most advanced economies (e.g., the US, Japan, the UK, the Netherlands, France, and Germany) to the developing ones (e.g., India, Russia, and Brazil). In each country, a representative sample of economic sectors has been studied covering a broad spectrum of products and services. The result is a unique perspective on productivity and its contribution to economic growth.

ACKNOWLEDGEMENTS

The working team consisted of consultants from the McKinsey Global Institute and the French and German Offices: Olivia Antelmann, Mourtaza Asad-Syed, David Bergonzo, Alena Brunn, Carsten Dörfler, Hans-Marc Erkinger, Anne Gacon, Arne Germeyer, Marion Grote-Westrick, Moritz Gruber, Thomas Gutjahr-Löser, Marcus Kleinfeld, Jeanne Lubek, Harald Meilicke, Guntram Nöth, Michael Otremba, Baudouin Regout, Dirk Reiche, Vincent Rondot, Jack Sheu, and Bedii Can Yucaoglu.

The report benefited from the expertise of McKinsey Partners and Associate Principals: Tony Blanco, François Bouvard, Frank-Detlef Drake, François Glémet, Michael Kliger, François Lepicard, Peter Leukert, Christian Malorny, Jean-Christophe Mieszala, Eric Monnoyer, Carl-Stefan Neumann, Jürgen Schrader, Lothar Stein, Sandra Sultan, Jérôme Teissier, Tidjane Thiam, and Andreas E. Zielke.

Editing and production were performed by: Jörg Hanebrink, Ivan Hutnik, Marc-Daniel Kress, Catherine Leroy-Jay, Ginni Light, Christiane Özmen-Flor, Chantal Pommier, Naima Sboron, Ulrich Scholz, Jonathan Turton and Stéphane Veyer.

Utilities

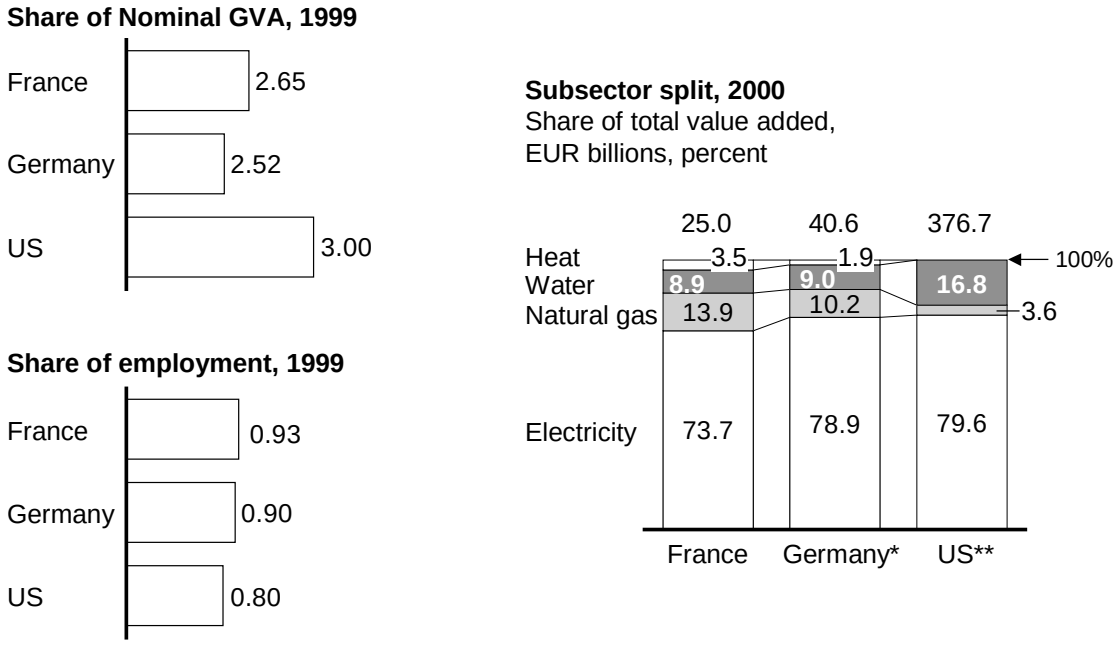
INTRODUCTION

The utilities sector underwent substantial change during the 1990s, this change being driven by liberalization and regulatory developments. Productivity growth in this industry not only influenced national GDP directly but also had an impact on input prices for other industries and, therefore, on the competitive situation of the whole economy.

Utilities comprises the generation and distribution of energy (i.e., electricity, natural gas, and heat) and water. It accounts for roughly one percent of employment and creates between two to three percent of GVA[1] in each country considered (Exhibit 1).

Exhibit 1

AGGREGATE SECTOR OVERVIEW – SIZE AND CONTRIBUTION



* For Germany based on 1998 figures
** For US no separation of heat available
Source: Statistisches Bundesamt, INSEE, MGI

[1] Share of the total economy excluding Public Administration and Real Estate Rental Sectors.

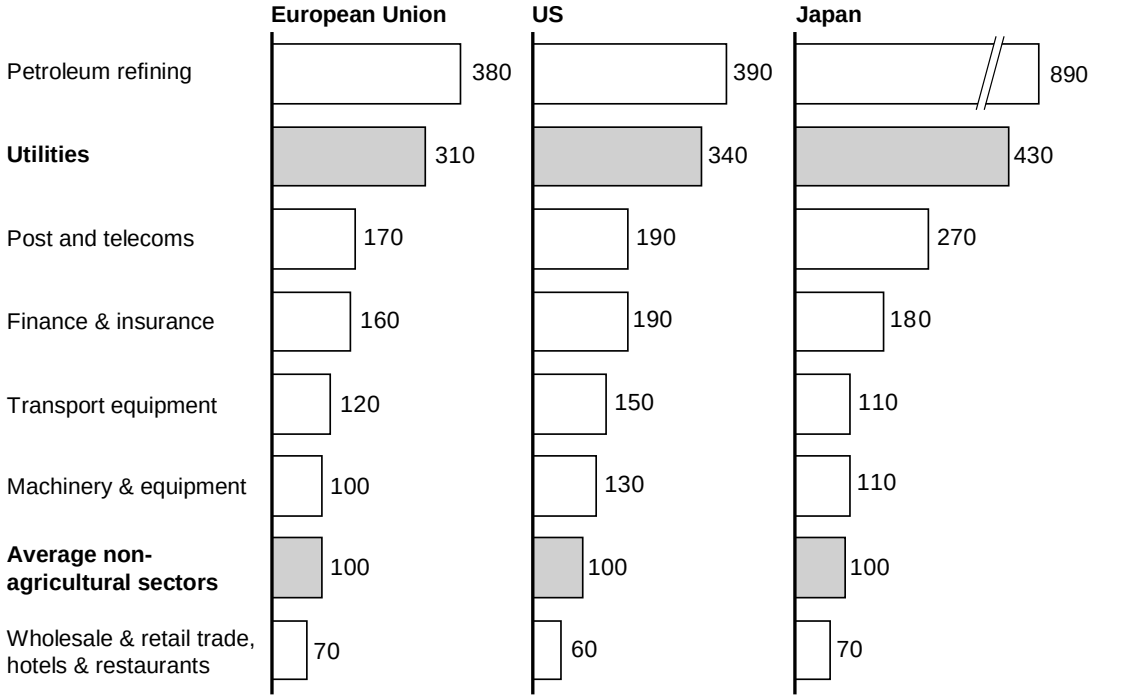
Utilities also reached high levels of productivity compared to other sectors of the economy[2] (Exhibit 2).

Exhibit 2

SIZE OF LABOR PRODUCTIVITY PER SECTOR, 1998

Index 100 = average labor productivity non-agricultural sectors

SELECTED EXAMPLES



Source: OECD economic outlook 2001

¶ According to official statistics, in the period from 1992 to 1999, labor productivity in utilities measured in value added per FTE grew above national productivity growth averages by 3.4 percentage points in Germany, 2.2 percentage points in France, and 1.3 percentage points in the US.

¶ The 1990s were characterized by a strong push towards liberalization, although countries started this process at different times and proceeded at different speeds. The UK – starting from a low productivity level – was more radical in its reforms and is, therefore, included in this analysis that otherwise focuses on Germany, France, and the US[3]. France managed to protect its providers against competition significantly longer than the

2 Source: OECD Economic Outlook, Table D.4.1.

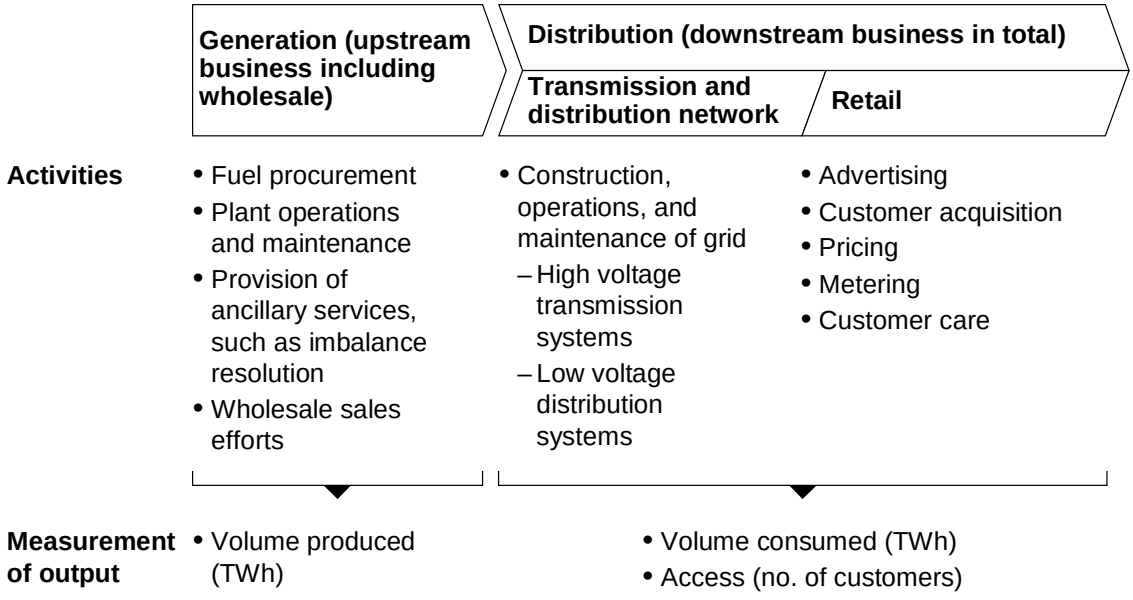
3 The UK data used throughout this report refers to England and Wales, specifically, and not to the entire United Kingdom.

other countries observed. The countries studied reflect the wide variety of regulatory developments and their varying impact on productivity.

There are two structurally different tasks within the utility sector: the upstream business of energy generation and trading, and the downstream business of distribution. The latter comprises the monopoly businesses of the transmission (high voltage) and distribution (low voltage) networks, as well as all sales activities. The economics behind these tasks are different; we, therefore, analyze changes in productivity of the generation and distribution activities separately (Exhibit 3).

Exhibit 3

ELECTRICITY VALUE CHAIN



Source: MGI

In this study we focus on electricity generation and distribution, as regulatory changes were most significant in these areas. We thereby cover approximately 65 percent of employment and 75 percent of total value added in the utilities sector.

The electricity and gas distribution subsectors are highly intertwined, as many distribution companies engage in both businesses; gas has also become an important input into the production of electricity in a number of countries. Nevertheless, regulation follows different paths and schedules in the two sectors. Therefore, although our analysis focuses on electricity, we will briefly discuss gas distribution, in terms of its similarities and differences to electricity.

IT is one of the factors that influence productivity development in the utility sector. However, electricity distribution consumes the lion's share of the IT expenditure and it is here that IT played a more significant role as an enabler of development in the 1990s. We, therefore, discuss IT in the distribution section in more detail. In electricity generation, IT was a driver of automation and remote control, as well as an enabler of the trading businesses established during the course of market deregulation.

Electricity generation

EXECUTIVE SUMMARY

The electricity generation sector accounts for about one-third of overall employment in electricity in the US, Germany, and France. In Germany, the market is dominated by four large players, generating about 80 percent of total electricity production. The French market is even more concentrated, with state-owned EdF accounting for about 93 percent of all electricity generated. The US, by contrast, is highly fragmented, with several hundred electricity utilities and dozens of independent power producers.

Labor productivity performance

Labor productivity grew rapidly from 1992 to 1999. In Germany the growth rate was 5.2 percent a year and in the US 5.5 percent a year. France, meanwhile, showed a more moderate growth of 1.3 percent a year, causing it to lose the leading position that it held at the start of the 1990s. By the end of this period, France lagged the US by 20 percent and, despite strong growth, Germany was behind France and lagged the US by 27 percent.

Total factor productivity

Total factor productivity (TFP) improved in the 1990s in generation. Combining capital, fuel, and labor productivity, reveals that France had the lowest growth, at just 0.6 percent CAGR, compared to 2.1 percent in Germany and 2.2 percent in the US. France lost its initial leadership position and in 1999 stood at 90 percent of the US level, while Germany was at 87 percent of the US level. Labor productivity proved to be the major driver of change within TFP and is, therefore, focused on here.

Drivers of labor productivity growth and level differences

A series of operational improvements during the 1990s brought about most of the productivity growth. These were triggered by various regulatory changes in the markets.

- *Firm-level factors* – Capacity utilization generated high growth in the US, although this was more due to underinvestment in new capacity than to operational improvements. Germany improved operational efficiency, especially in East Germany, while government intervention in France

hindered improvement by insisting that EdF maintained staff levels significantly above its preferred target levels.

¶ *Industry-level factors* – Liberalization and other changes in the regulatory framework put economic pressure on generators to improve their performance, especially in the US and Germany. Decisions on capacity mix taken prior to the 1990s helped France to hold a leading position at the start of this period. Primarily, this was due to its focus on nuclear power which is less labor-intensive than other forms of power generation. European labor productivity generally suffered, as compared to the US, because of the more stringent environmental standards that Europe faced. For Germany, environmental standards accounted for four percent of the difference in labor productivity compared to the US.

Outlook and recommendations

Liberalization and regulatory changes will continue to shape productivity growth. German productivity is likely to continue to grow at high rates, closing the gap to France. France has substantial potential for operational improvements, as long as the political and competitive environment allows it. US productivity growth is likely to slow as the high degree of capacity utilization is unsustainable at its current levels and new capacity will need to be built to resolve the current capacity problems.

OVERVIEW OF THE SECTOR I (SUBSECTOR GENERATION)

On average, electricity generation accounts for about one-third of employment in the electricity sector in the US, Germany, and France, with employee numbers of approximately 240,000 in the US, and 40,000 in both France and Germany.

Industry profile

The German electricity generation industry is dominated by four large players, which generate about 80 percent of the total electricity production. All these companies are either listed companies or are owned by foreign companies. They are also active in transmission, distribution, and retail. Power generation in Germany is based on lignite (29 percent), hard coal (22 percent), and nuclear fuel (33 percent).

The French electricity generation market is extremely concentrated. EdF, the state-owned *de facto* monopoly, accounts for 93 percent of all electricity generated. Some 55 percent of the installed capacity is nuclear power, which generates three-quarters of all French electricity. Due to the low variable cost of nuclear power plants, France is able to export large amounts of electricity. This led to the net export of 15 percent of total production in 2000.

The US generation industry at the end of the 1990s comprised several hundred electricity utilities and dozens of independent power producers, whose numbers are growing. Publicly traded companies own approximately 80 percent of the generating capacity in the US. The main technologies used are coal, accounting for 52 percent of installed capacity, nuclear with 19 percent, gas with 15 percent, and hydro with 9 percent. Due to substantial transmission constraints, the US has to be regarded as consisting of multiple local markets. The timing of deregulation, as well as the model to be adopted, is state-dependent; those states that have already deregulated (representing 15 to 20 percent of installed capacity) had divested roughly half of their generation assets from public ownership by the end of the 1990s.

LABOR PRODUCTIVITY PERFORMANCE

The major driver of productivity increases in electricity generation is usually the more efficient use of the labor force. Labor productivity is, therefore, a good indicator of performance improvements and the differences between countries. However, capital and fuel productivity are also pertinent factors for understanding both productivity development as a whole, as well as any possible trade-offs between

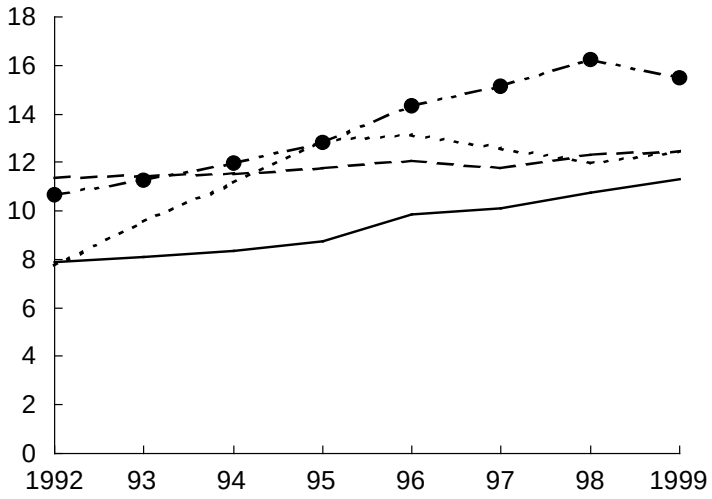
changes in labor and capital productivity. Therefore, we will also briefly discuss capital productivity, fuel productivity, and total factor productivity.

The MGI analysis of labor productivity in electricity generation is based on the physical measurement of production output measured at TWh produced. It is the most straightforward measure, especially for analyzing growth and national differences. Deflators, or PPP models, are not appropriate as they use the concept of added value. Labor input is based on full-time equivalents (FTEs), leveling out any differences between countries in terms of the hours worked.

Labor productivity grew rapidly from 1992 to 1999 at 5.2 percent a year in Germany, and at 5.5 percent a year in the US. France showed a more moderate growth of 1.3 percent a year. As a result, France lost its leading position in the early 1990s and lagged the US by 20 percent in 1999. Despite strong growth, Germany's productivity was still behind France, and lagged the US by 27 percent at the end of the 1990s (Exhibits 4-6).

Exhibit 4

LABOR PRODUCTIVITY – ELECTRICITY GENERATION
GWh/FTE



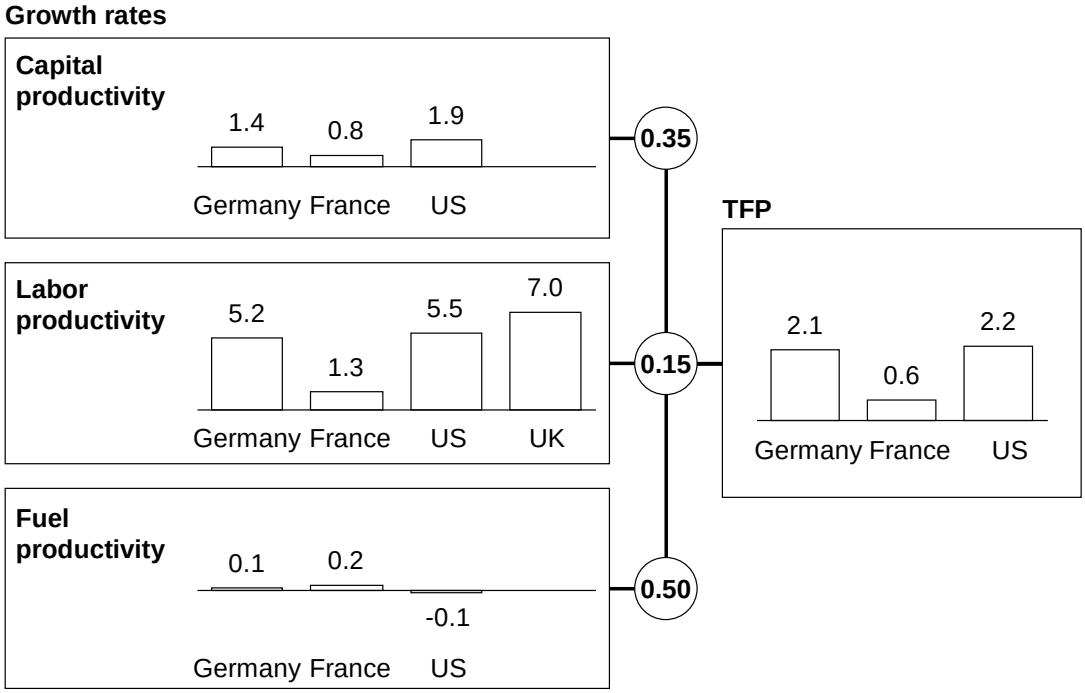
CAGR, 1992 - 2000 Percent	
France	1.3
Germany	5.2
UK	7.0
US	5.5

* Excluding industrial power production
** England and Wales
Source: MGI analysis

Exhibit 5

PRODUCTIVITY GROWTH – ELECTRICITY GENERATION

CAGR percent, 1992 - 99

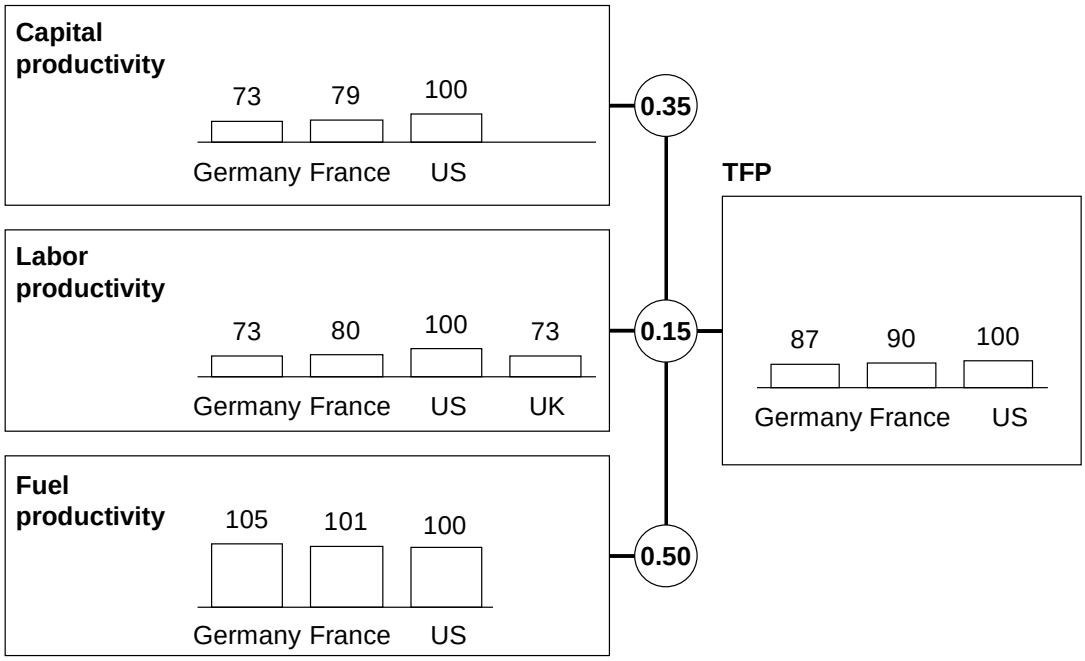


Source: MGI analysis

Exhibit 6

PRODUCTIVITY LEVELS – ELECTRICITY GENERATION

Index 100 = US level 1999



Source: MGI analysis

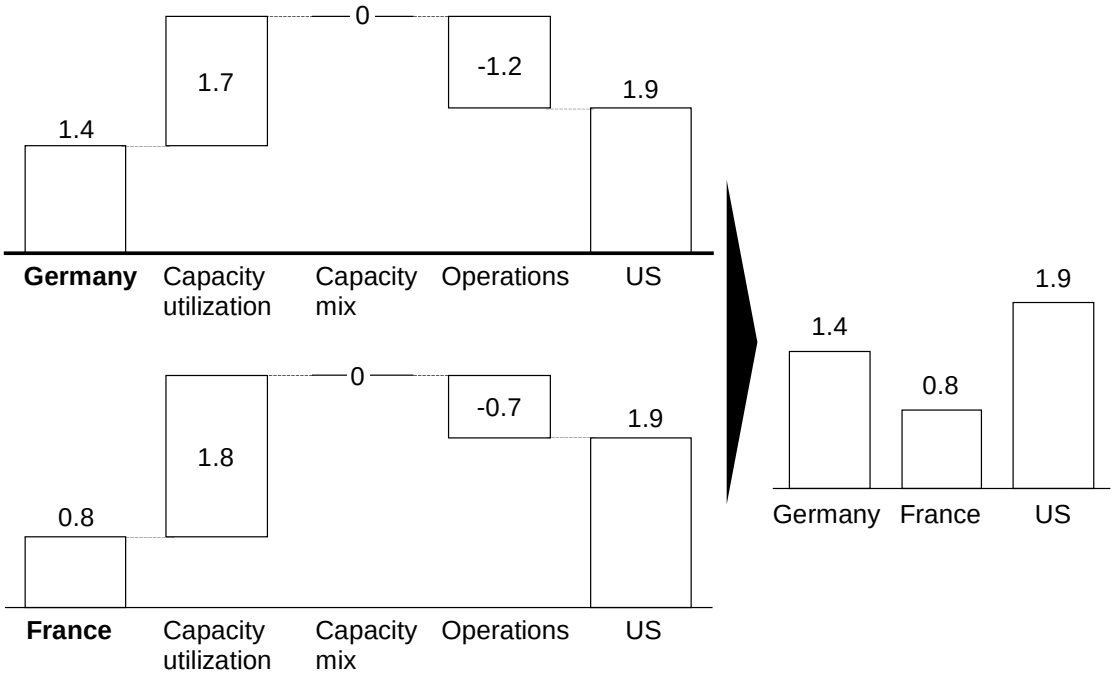
Capital and fuel productivity

Looking at TFP[4], France had the lowest growth at just 0.6 percent CAGR. This caused it to lose its initial leadership position and in 1999 it stood at 90 percent of the US level, while Germany was at 87 percent of the US.

- *Capital productivity* – Although Germany and the US attained capital productivity growth rates of 1.4 and 1.9 percent a year, respectively, French capital productivity growth remained moderate at 0.8 percent a year. At the end of the 1990s, Germany was at 73 percent of the US level, and France was 79 percent (Exhibits 7, 8).

Exhibit 7

CAPITAL PRODUCTIVITY GROWTH – ELECTRICITY GENERATION
CAGR percent, 1992 - 99



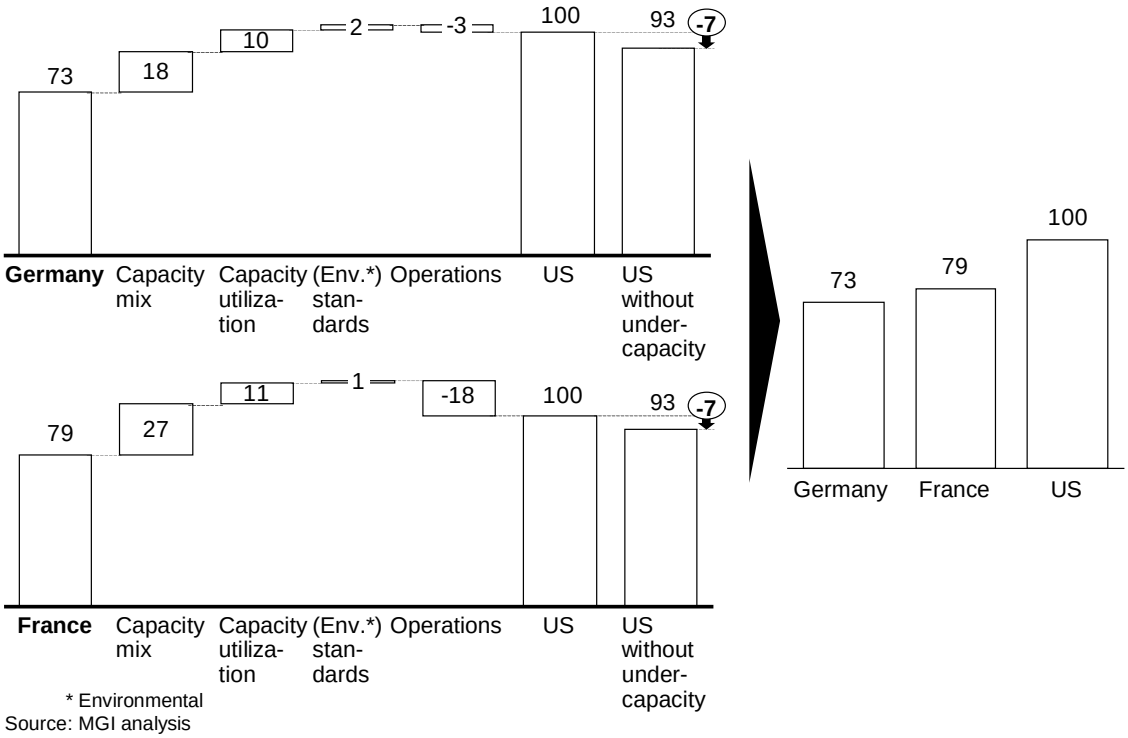
Source: MGI analysis

4 TFP = total factor productivity. Aggregation of fuel productivity (FP), labor productivity (LP), and capital productivity (CP) into a single productivity number for growth and level using Cobb-Douglas production function, i.e., $TFP = LP^{\alpha} CP^{\beta} FP^{\gamma}$ with $\alpha + \beta + \gamma = 1$. Weights are based on average cost, i.e., $\alpha = 0.15$, $\beta = 0.35$, and $\gamma = 0.5$.

Exhibit 8

CAPITAL PRODUCTIVITY LEVELS – ELECTRICITY GENERATION

Index 100 = US level 1999



* Environmental

Source: MGI analysis

¶ *Fuel productivity* – France was slightly ahead with growth rates of 0.2 percent a year, while Germany achieved 0.1 percent a year. In 1999, Germany, nevertheless, still had a 5 percent advantage over the US and France (see Box 1: Fuel Productivity).

As TFP shows similar trends to those described above, labor productivity seems to be a good proxy for the productivity performance of the sector and is, therefore, used as the basis of the causality analysis.

DRIVERS OF LABOR PRODUCTIVITY GROWTH AND LEVEL DIFFERENCES

The causality of these differences is analyzed in terms of firm-level factors and industry-level factors, reflecting the degree of influence of the companies to change the driving forces behind these developments.

Firm-level ("operational") factors

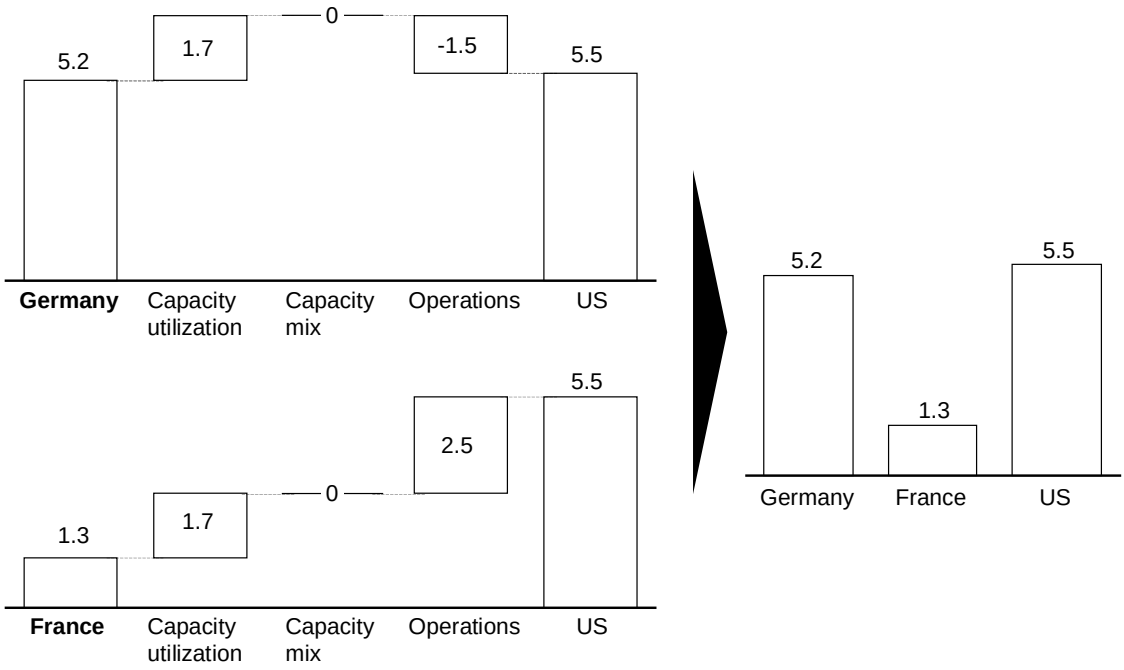
Over the 1990s, labor productivity increased mainly because of operational improvements and an increase in capacity utilization. These firm-level drivers explain a substantial part of the differences between the countries.

Capacity utilization. Once a power plant is up and running, the FTEs needed to keep it running remain almost constant irrespective of the unit's actual production. Any increase in output, therefore, automatically increases labor productivity. Of the three, the US managed to increase capacity utilization the most substantially, producing labor productivity growth in excess of the other two of around 1.7 percent a year (Exhibit 9).

Exhibit 9

LABOR PRODUCTIVITY GROWTH – ELECTRICITY GENERATION

CAGR percent, 1992 - 99



Source: MGI analysis

In consequence, in 1999 utilization rates in the US were around 10 percent higher than in France and Germany (Exhibit 10).

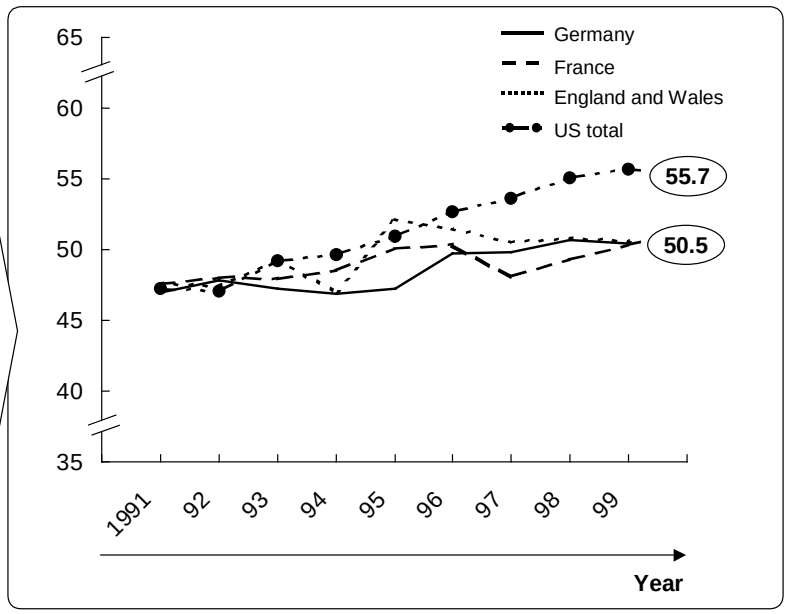
Exhibit 10

CAPACITY UTILIZATION DEVELOPMENT

Capacity utilization, percent

Background

- Labor productivity is directly linked to capacity utilization of power plant
  - FTEs needed regardless of what production is
  - FTEs linked with capacity installed
- US total is now short of capacity installed; operators forecast huge investments for the coming years (+7%)



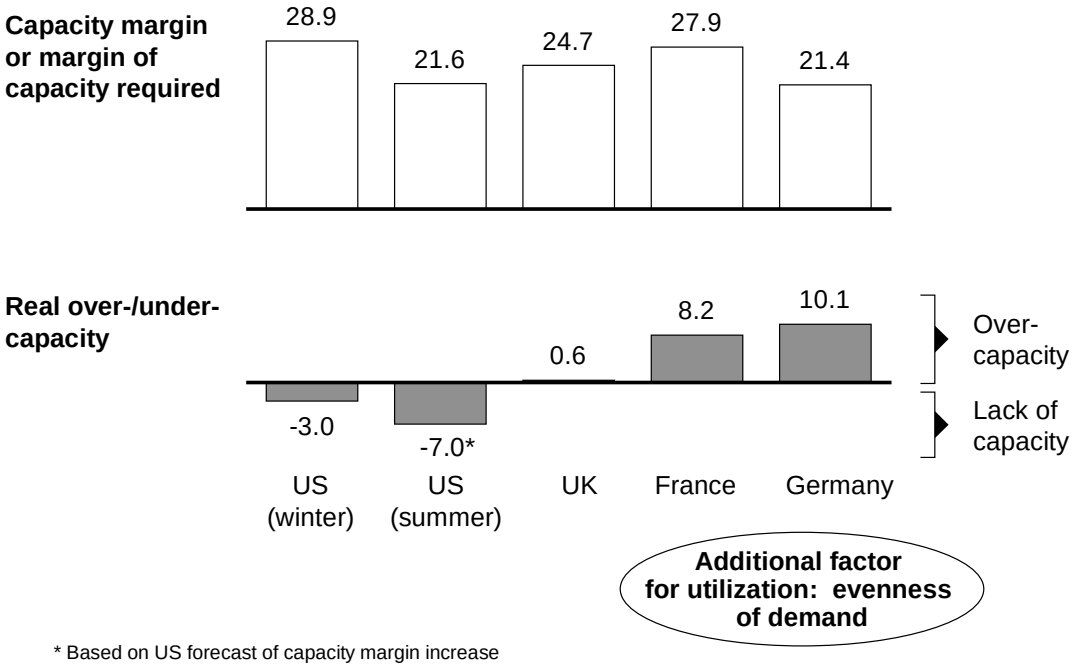
Source: BMWI, DIGEC, EIA, Platt's, MGI analysis

Although the high capacity utilization growth in the US was in part based on the optimization of US generators, it was also driven more fundamentally by under-investment in new capacity during a time of growing demand. This was mainly due to the instability of both the regulatory environment and the economic conditions, providing low predictability of wholesale prices for generators. This gave incumbents few incentives to invest, eventually leading to undercapacity. An estimate for 2000 showed that an additional capacity of seven percent was required in the US power system to match consumer demand[5]. Over time, the US's labor productivity advantage is likely to be reduced by a corresponding seven percent, as this new capacity is added (Exhibit 11).

5 Estimate based on technical estimate of reserve margin required in comparison to summer peak in 2000 (22 percent) and actual reserve capacity available (15 percent). As actual reserve capacity requirements are set by regions and vary between regions, they might (as the mathematical sum of the regional requirements) lead to slightly different overall capacity requirements.

Exhibit 11

CAPACITY MARGIN IN GENERATION, 2000
Percent



* Based on US forecast of capacity margin increase
Source: EIA, Eurelectric

Operational efficiency. The reorganization of functions and tasks, the standardization of processes, or the reduction of labor overcapacity are all ways of improving productivity.

Despite similar total labor productivity growth during the 1990s, the contribution from operational efficiency increases was 1.5 percentage points higher in Germany than in the US. This was partly driven by the one-off effect of the necessary modernization of the East German generation plants. Mergers of generators also helped to improve operational efficiency.

The high rate of productivity growth enabled Germany to catch up with US operational performance, once corrections for the different capacity mix and capacity utilization in both countries are made. This does not imply complete convergence in operational performance but reflects that the totality of factors driving productivity, beyond capacity mix and capacity utilization – such as organizational differences, impact of different standards, and legal requirements – had a similar impact on productivity in Germany and the US.

France, on the other hand, lagged behind both countries in 1999 in terms of operational performance, exhibiting a 23 percent gap compared to US levels. This was mainly due to the lack of incentives for the state-owned generation plants either to

eliminate overemployment or to increase the standardization of processes to improve productivity.

Box 1 – Fuel productivity

Complementing labor and capital productivity, fuel productivity is the third major factor in a comprehensive productivity comparison. It cannot be neglected given that it can account for up to 50 percent of costs; however, it does not show up as a primary source of productivity improvement because it is subject to technological and physical constraints.

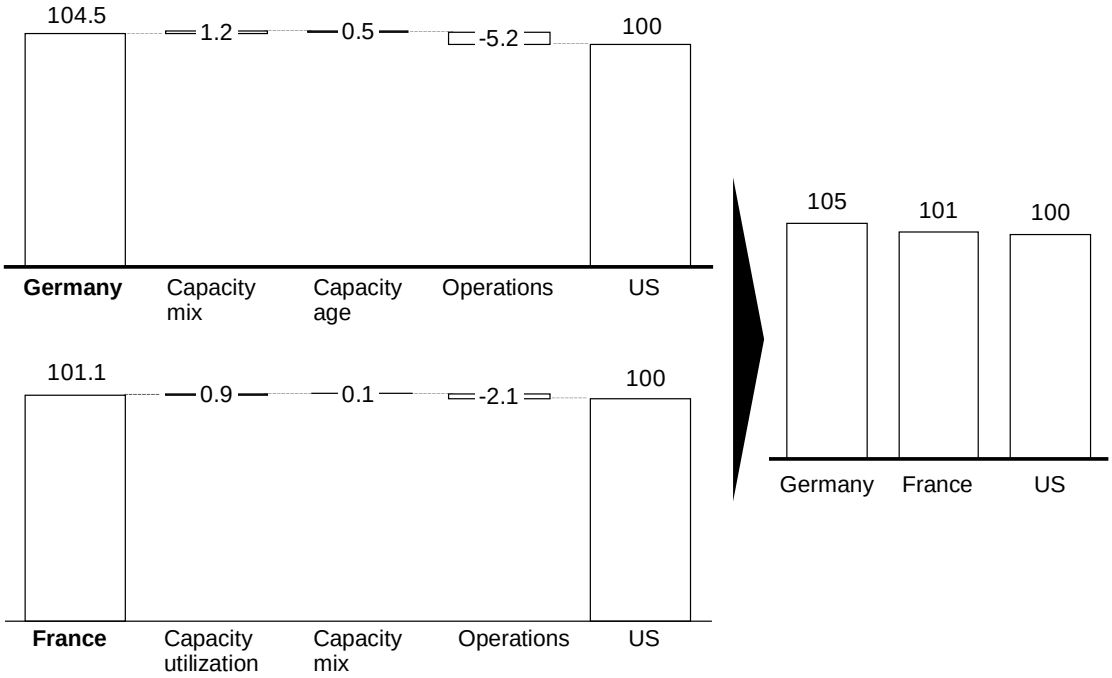
Fuel productivity shows the efficiency of converting the fuel input into power and is dominated by technological choice. At the end of the 1990s, Germany was five percent more productive than the US and four percent ahead of France in terms of fuel productivity.

Capacity mix and capacity utilization explain only a minor part of this difference; the main source of Germany's advantage stems from significantly higher fuel efficiency in German coal-fired power plants (Exhibits 12, 13).

Exhibit 12

FUEL PRODUCTIVITY LEVELS

Index 100 = US level 1999

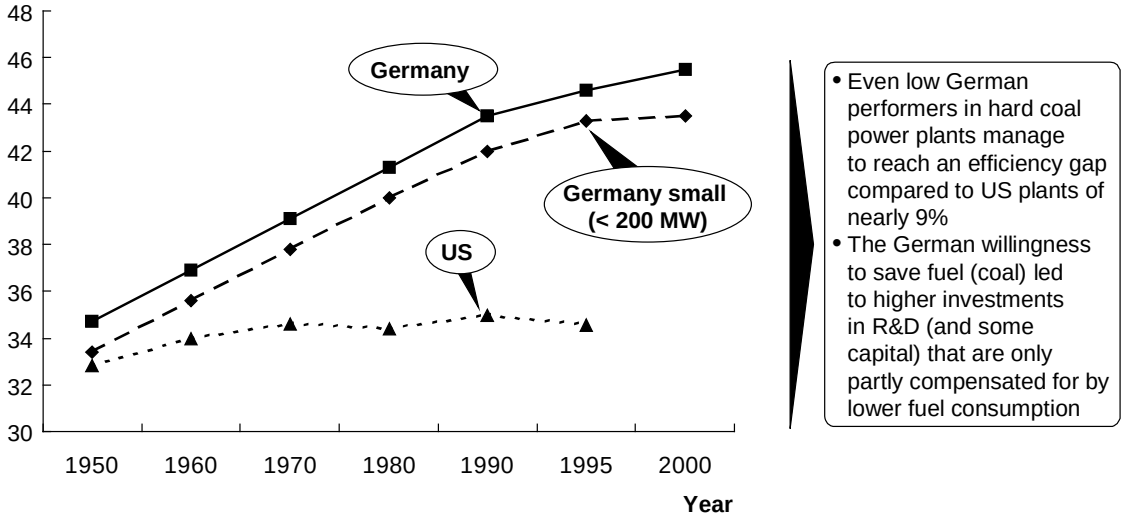


Source: MGI analysis

Exhibit 13

HARD COAL POWER PLANT FUEL EFFICIENCY DEVELOPMENT, 1950 - 2000

Percentage of fuel efficiency of newly commissioned hard coal power plants



Source: UDI, MGI analysis

Fuel efficiency in new coal-fired power plants rose to 45 percent, compared to fuel efficiency levels of about 34 percent in the US. This situation is the result of a development that started back in the 1950s; since then, efficiency in new power plants has improved significantly in Germany, while remaining more or less constant in the US. This shows that German power generators placed far greater emphasis on obtaining greater fuel efficiency than their US peers did. This difference is due, at least in part, to the fact that coal is a much cheaper resource in the US than it is in Germany (at least, once German coal subsidies were removed).

However, fuel productivity growth shows only marginal improvement over time in all three countries. This is because a power plant's efficiency does not change substantially after construction. France managed slightly higher growth than the US or Germany because of the recent addition of more efficient capacity.

Industry-level ("external") factors

The main external drivers of productivity growth and inter-country differences were liberalization and changes to the regulatory framework, capacity mix, and environmental standards.

Liberalization of the energy market. At the end of the 1990s, Germany, in a single step, opened up the wholesale and retail market and introduced freedom of choice of provider for the consumer. Falling prices – especially in the wholesale market – put pressure on generators, who had started to prepare for this from the mid-1990s onwards by improving operational performance and, consequently, their labor productivity.

Market liberalization was limited in France during the 1990s, allowing EdF to preserve its monopolistic position in the mass market. For commercial clients, only the minimum EU requirement of free choice for consumers above 100 GWh by February 1999 was fulfilled (above 16 GWh by February 2000). As a consequence, EdF remained the only significant generation company in France and was not exposed to the competitive pressures that other European generators started to feel. EdF also benefited from the monopoly structure of its nuclear sector, in terms of capital productivity. Construction and maintenance costs are substantially lower in France, due both to the more standardized layout of French nuclear power plants and to France's significant purchasing power when buying a series of power plants.

The US regulator spurred new entrants into the power generation sector through regulatory intervention. Historically, regulation for generation (state- and federal-based) had been built on cost-based rate-making processes that allowed generators to earn predefined levels of profits. In 1978, the Public Utility Regulatory Policies Act (PURPA) freed certain types of generation from cost regulation and required selected incumbents to purchase their output. PURPA created an environment that introduced competitive bidding for new capacity, leading to additional new independent power producers entering the market. Competition in generation in an uncertain competitive environment (e.g., with the threat of price caps on peak output), in combination with state prudence reviews, and the uncertain economic conditions of the 1980s and early 1990s, meant that incumbents chose not to build capacity. This decision, combined with continued demand growth in the 1990s, eventually led to a shortfall in capacity of seven percent relative to target capacity margins. This shortfall increased utilization of the existing capacity and, thus, labor and capital productivity. By the end of the 1990s, regulatory developments (including open access to the transmission network), price signals (including the Midwest price spikes seen in 1998-99), and the economics of combined cycle and combustion turbine generation technology, driven largely by low natural gas

prices, provided incentives for incumbents and independent power producers to begin adding new capacity.

Capacity mix. The capacity mix in Germany at the end of the 1990s was the result of developments over the last 30 years. Renewable resources such as hydro power were in limited supply, whereas coal, especially lignite, was readily available. Meanwhile, the political choice was to allow nuclear power but not to promote it aggressively. This all resulted in a German capacity mix that focused on lignite (29 percent), hard coal (22 percent), and nuclear power (33 percent). The historic push for hard coal was linked with the political desire to support the coal mining companies through heavy subsidies.

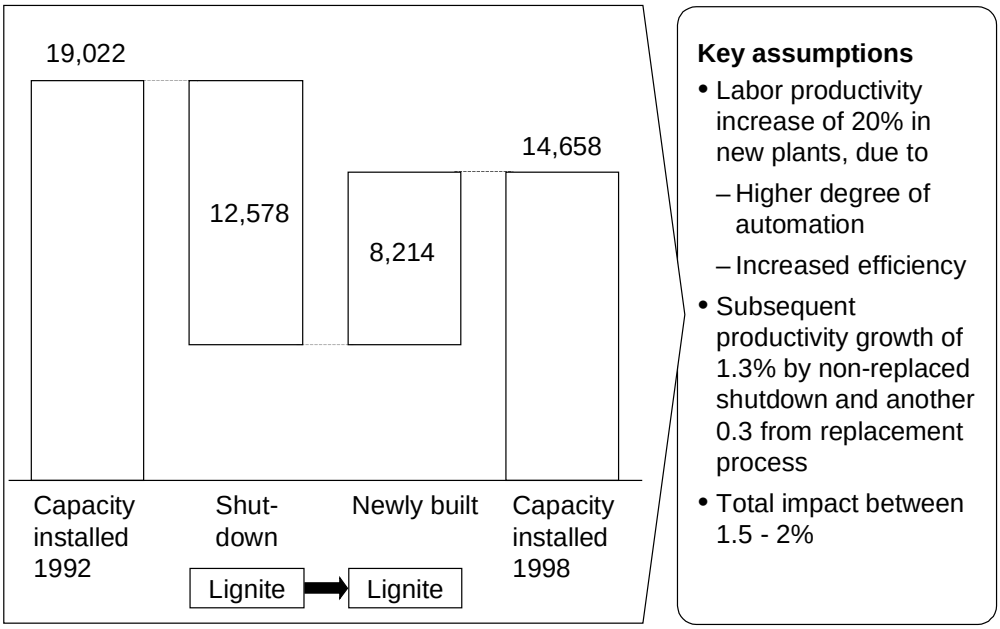
Following the oil crisis in the 1970s, France actively decided to opt for nuclear power plants. This was supported by the desire to reduce dependence on external energy sources and led to a systematic buildup of nuclear power plants in the 1970s and 1980s. The share of nuclear energy remained virtually unchanged over the 1990s due to the limited capacity additions. The share of nuclear power plants had a clear influence on labor productivity. Compared to other thermal power plants, the staffing needs of nuclear power plants are lower and the potential therefore exists for higher labor productivity in France. However, this potential has not yet fully materialized due to the limited pressure on EdF to drive productivity by reducing staffing levels.

Changes in capacity mix over the 1990s were largely insignificant and the net effect on labor productivity growth was very limited in the US and France. In Germany, reunification led to the modernization of East German power plants in order to improve both their environmental performance and their labor productivity. In total, 12.6 GW of lignite capacity was replaced by 8.2 GW of new lignite capacity. 4.4 GW was simply shut down, accounting for a 1.3 percent contribution to labor productivity growth. The other 8.2 GW was replaced by more efficient generation capacity of a corresponding 8.2 GW, accounting for 0.3 percent labor productivity growth (Exhibit 14).

Exhibit 14

CAPACITY INSTALLED BY UTILITIES IN EAST GERMANY AND CHANGES THAT OCCURRED

MW



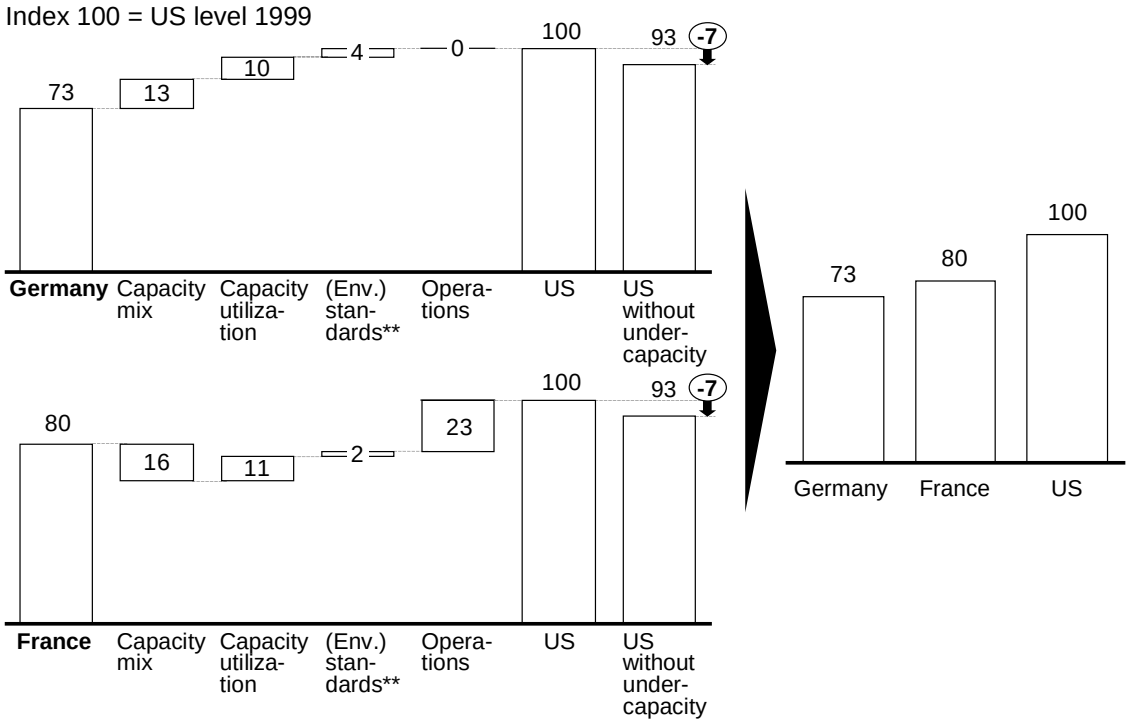
Source: MGI analysis

The capacity mix is a major factor behind the different overall levels of labor productivity in each country. The substantially higher share of labor-intensive coal-fired power plants in the US, compared to France, together with a significantly lower share in less labor-intensive nuclear power plants gives France a significant advantage over the US. The resulting impact on overall labor productivity levels is that the capacity mix gives France a 16 percent advantage compared to the US, and Germany a 13 percent disadvantage as compared to the US (Exhibit 15).

Exhibit 15

LABOR PRODUCTIVITY LEVELS* – ELECTRICITY GENERATION

Index 100 = US level 1999



* Based on TWh produced/FTE ** Mainly environmental, other standards partly included

Source: MGI analysis

The impact of the capacity mix on capital productivity differs from its impact on labor productivity, as the two do not correlate according to the type of power plant. The capacity mix explains a US advantage in capital productivity over Germany of 18 percent and over France of 27 percent.

Technological innovation had only a limited direct impact during the 1990s. CCGT (combined-cycle gas turbines) became slightly more important, due to their high overall efficiency rates but there were relatively few installations during the 1990s in any of the three countries**,** and no measurable shift in capacity mix overall. Other technologies (e.g., fuel-cells, decentralized generation) remain under discussion but as yet no clear business case has emerged and their potential impact remains unclear.

Standards. Environmental and health and safety standards differ between the US and Europe, with those in the latter generally being substantially higher; complying with these requirements is one source of the difference in productivity levels. Many different requirements have an impact on productivity, such as space requirements for certain tasks (e.g., walkways for employees and shaft size for cables), to noise-protection devices, and architectural restrictions. Environmental standards play a particularly important role in driving labor requirements for power plants.

The difference is especially visible for coal-fired power plants, where the installation of emission-reducing technology translates into higher labor requirements for European coal-fired power plants. Although some parts of the US impose high standards comparable with those in Europe, others impose only modest requirements on power generators. In terms of labor productivity levels, these differences in standards account for approximately four percentage points advantage of the US over Germany; however, the US has a significantly smaller advantage over France because of the lower share of coal-fired power plants in use there.

OUTLOOK AND RECOMMENDATIONS

Liberalization and regulatory changes increased competition and drove productivity during the 1990s, and will continue to shape productivity growth over the coming years. German productivity is expected to continue to grow at high rates over the next few years, as it continues to narrow the gap with France (that currently stands at 15 percentage points). In France, there is substantial potential for operational improvements, but their realization will depend on the political and competitive environment. US productivity growth is likely to slow down as the high degree of capacity utilization is unsustainable, and new capacity will need to be built.

Germany

A significant increase in productivity is expected from Germany's power generators over the next few years, especially in labor productivity, but growth rates are likely to be more moderate than during the 1990s.

Following the 1998 liberalization, market pressures led to a sharp fall in energy wholesale prices, putting pressure on generators to increase productivity considerably. Even before 1998, generators were working on improving productivity in anticipation of the competition after 1998. This pressure will continue to drive productivity over the next few years. The modernization of East German plants is also complete, so the rapid productivity growth rates there will now fall into line with the rest of the country.

France

France's development in the near future is unclear and there are currently only a few signs of increasing productivity growth.

There are significant productivity improvements still to be captured in France, as the experience of both Germany and the US testifies. After correcting for the

capacity mix, capacity utilization, and differences in standards, France still lags the US by 23 percent, suggesting substantial room for improving operations.

However, the pressure to improve productivity remains limited. The opening of markets to competition has progressed slowly and pressure from the state – the owner – is muted, due to the political pressures to protect employment.

US

The high US growth rates are unlikely to be sustainable and labor productivity may, in fact, fall in the near future, given the expected capacity additions needed to relieve the present undercapacity situation. These capacity additions are necessary for the stabilization of the generation sector, balancing supply and demand in the near future.

US undercapacity has partly resulted from regulation. This demonstrates the importance of having a balanced competitive system. Long lead times for additions to capacity make careful planning essential and the constant monitoring of capacity development a crucial element of any regulatory system.

Now that incumbents can assess the economic viability of building capacity more reliably, investment is starting. The announced construction of new capacity will relieve the current undercapacity, despite the further demand growth of 2.5 percent CAGR up to 2005 forecast by the EIA (Energy Information Administration). The additional capacity will cause both capacity utilization and, therefore, labor productivity to fall.

US discussions on raising environmental standards could result in increased staffing and capital requirements and may have a further negative impact on productivity growth. However, there is only a limited likelihood of these discussions actually resulting in more stringent standards in the short term.

Electricity distribution

EXECUTIVE SUMMARY

Distribution accounts for about two-thirds of electricity sector employment in the countries analyzed. In France, EdF dominates distribution more than just generation, delivering about 97 percent of all electricity consumed. The German transmission (high voltage) network is operated by four major generation companies but the distribution (low voltage) and retail sectors are highly fragmented. The US electricity distribution industry is also highly fragmented with some 3,000 companies. The UK is included in this study as it has been the most radical reformer in this sector and serves as an interesting benchmark.

Labor productivity performance

Distribution output can be measured by access to electricity and volume of electricity delivered.

- *Volume* – The UK achieved the highest productivity growth rates, at 8.0 percent a year, followed by the US (6.4 percent), Germany (5.3 percent), and France (3.7 percent). In 2000, the US was a long way ahead of the European countries in its productivity levels, with France, Germany, and the UK at 56, 55 and 49 percent of the US level, respectively.
- *Access* – The UK again achieved the highest growth with 7.5 percent a year, followed by Germany and the US (both at 5.3 percent), and France (2.8 percent). Overall, the US lags behind in this group, with the UK, France, and Germany having levels 18, 19 and 37 percent ahead of the US productivity level, respectively.

Total factor productivity

Growth patterns in total factor productivity, combining labor and capital inputs, were similar in distribution to those seen in labor productivity. The US had the highest growth rates, with France showing significantly lower levels of improvement. However, the gap in growth performance was smaller overall, thanks to France achieving slightly higher capital productivity growth rates. This was partly because Germany was forced to invest more in infrastructure during the 1990s.

Drivers of labor productivity growth and level differences

- *Firm-level factors* – Staff numbers were cut, though only partially in France, and outsourcing increased, considerably boosting overall labor productivity. The majority of these productivity increases were related to the network business in distribution, whereas the retail contribution was generally smaller because of the new tasks that arose as a result of the deregulated environment.

- *Industry-level factors* – Liberalization, privatization, and other regulatory changes all affected distribution. Such reform was the major driver for development. The UK moved towards a highly competitive structure with tight regulation in the network business, based on price caps. Labor productivity mainly improved as a result of regulatory pressures on the network business. At the other end of the spectrum, France continued to protect parts of the sector from competition and kept regulatory pressures on the networks at a low level, thereby losing its leadership position. Germany benefited from a relatively high customer density, while the US benefited from higher consumption per customer.

Role of Information Technology in Electricity Distribution

IT expenditure grew at impressive rates during the 1990s. In France, the utilities sector increased IT investment by 7.5 percent a year; in Germany it reached 8.0 percent. Only about 20 to 30 percent of this was aimed directly at increasing labor and capital productivity. For example, IT was used to improve operational planning and asset management, streamline metering and meter handling, and improve enterprise resource planning systems. IT also had an indirect effect in aiding the migration of a highly regulated sector towards a liberalized market with a competitive and decentralized industry structure.

Outlook and recommendations

Growth rates in Germany are likely to be sustained over the next few years, as most of the effects of the operational improvements are not yet visible. France's progress depends on the political and regulatory environment. The US is likely to enjoy higher growth as retail liberalization and regulatory pressures on network operations are only just beginning in some states. Productivity growth has already slowed in the UK and is likely to return to normal rates.

Regulation will have to ensure that incentives to improve performance are economically viable. In France and in Germany, there is room for future improvement in the regulatory framework, especially regarding the network operations in distribution.

OVERVIEW OF THE SECTOR I (SUBSECTOR DISTRIBUTION)

The distribution sector comprises the electricity transmission network (high voltage), the electricity distribution network (low voltage) and retail, and accounts for about two-thirds of employment in the electricity sector in the US, Germany, and France, with employee numbers of approximately 300,000 in the US, 75,000 in Germany, and about 70,000 in France.

Industry profile

In France, EdF dominates distribution even more so than it does generation, delivering about 97 percent of all electricity consumed. A separate transmission network operator (RTE) has been formed, owned by EdF, but with separate accounting and a demand for "Chinese walls" with EdF. Although the German transmission network is operated exclusively by the four companies that dominate the electricity sector overall, the distribution and retail market is highly fragmented. Approximately 900 companies operate in these segments, with about one-third of electricity consumed by end customers being supplied by the four large groups, one-third by regional distribution companies and one-third by a large number of local municipalities. While most of the regional suppliers are dominated by the four large groups, many of the local utilities are still owned by municipalities.

The US electricity supply industry is highly fragmented. There are approximately 3,000 players in the distribution and retail market, of which 200 are privately held utilities that account for more than 75 percent of electricity consumed by end customers. The other 2,800 companies are predominately owned by municipalities and cooperatives. The US transmission network is owned primarily by the privately held utilities, and current federal regulatory policy is aimed at consolidating operational control into larger regional networks. Liberalization of the retail trade began in California and Massachusetts in 1998 and, today, 24 states have authorized retail competition.

LABOR PRODUCTIVITY PERFORMANCE

Distribution output has two prongs: access to electricity and volume of electricity delivered. MGI calculated productivity levels and growth for both types of output. When we aggregated level indices and growth rates, we gave them equal weighting based on the rough share of costs in the retail price. The aggregated results are used as an indicator of overall performance, while detailed statements on productivity are always based on either access or volume. The input was FTEs adjusted for annual working time and outsourcing rates.

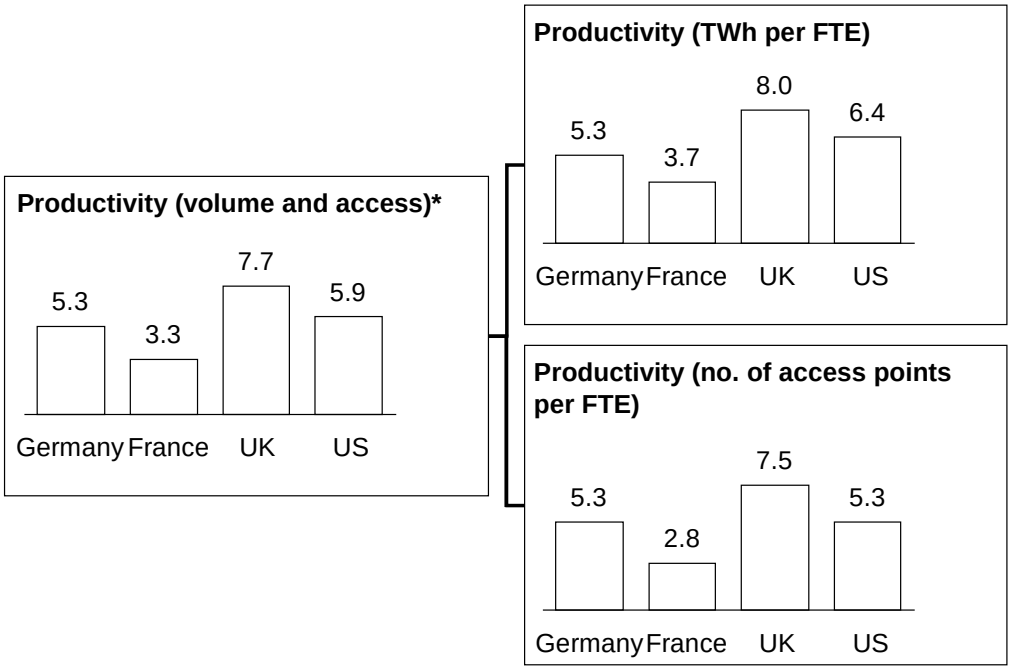
The analysis focuses on labor productivity because labor accounts for approximately 60 to 70 percent of total input costs. We also looked at capital productivity to see if increases in labor productivity came at the expense of capital productivity.

As a benchmark, the UK was included in the analysis since it has gone the furthest in terms of liberalization and regulatory changes and achieved the highest productivity growth during the 1990s.

Labor productivity in electricity distribution grew at 5.3 percent a year in Germany, 5.9 percent in the US, and 7.7 percent in the UK. French performance lagged well behind, at 3.3 percent, and France lost the position it had held as European leader at the beginning of the 1990s (Exhibit 16).

Exhibit 16

LABOR PRODUCTIVITY GROWTH – ELECTRICITY DISTRIBUTION
CAGR percent, 1992 - 2000



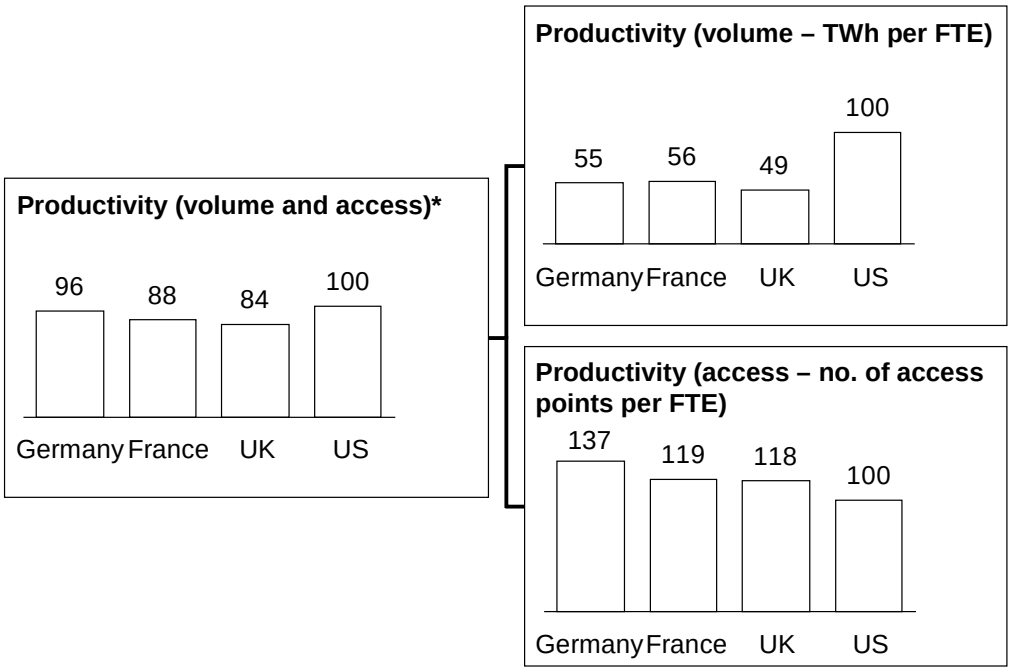
* Weighted 50% productivity (volume), 50% productivity (access)
Source: MGI analysis

In separating out access and volume productivity rates, the picture does not change substantially. Labor productivity levels based on volume converged in the European countries, but the US level was twice as high as that in France and Germany in 2000. Based on access however, the US was behind; Germany led the way, outperforming France by 13 percent (Exhibit 17).

Exhibit 17

LABOR PRODUCTIVITY LEVEL – ELECTRICITY DISTRIBUTION

Index 100 = US level 2000



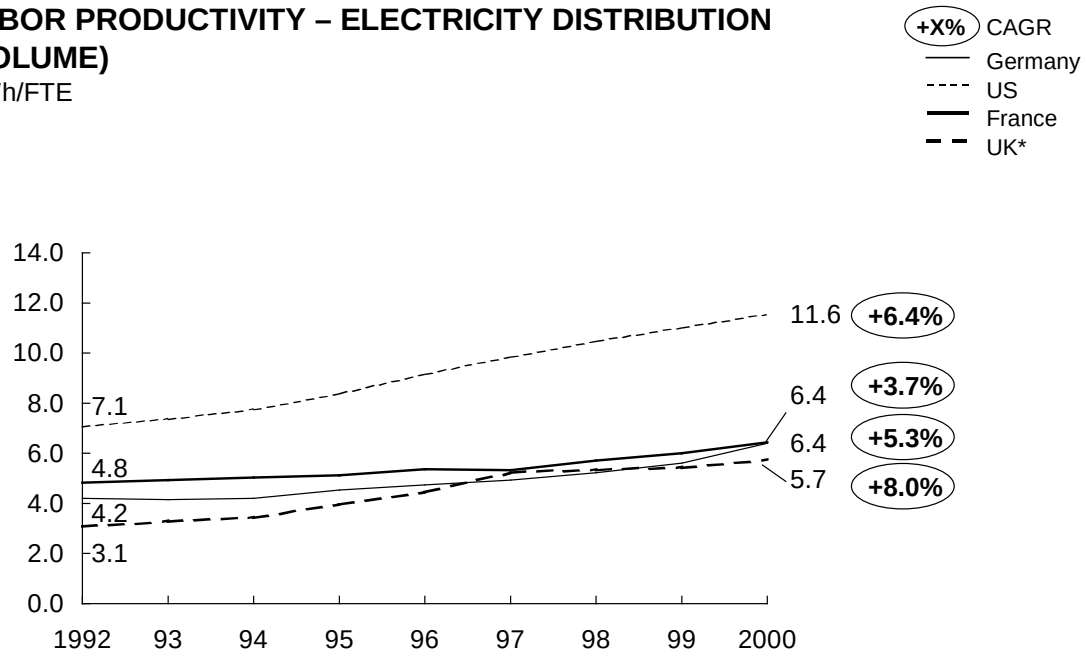
* Weighted 50% productivity (volume), 50% productivity (access)

Source: MGI analysis

¶ *Labor productivity: volume* – The UK reached the highest growth rates at 8 percent CAGR, followed by the US (6.4 percent), Germany (5.3 percent), and France (3.7 percent). In 2000, the US was a long way ahead of the European countries in its labor productivity level, with France, Germany, and the UK at 56, 55 and 49 percent of the US level, respectively (Exhibit 18).

Exhibit 18

LABOR PRODUCTIVITY – ELECTRICITY DISTRIBUTION (VOLUME)
GWh/FTE



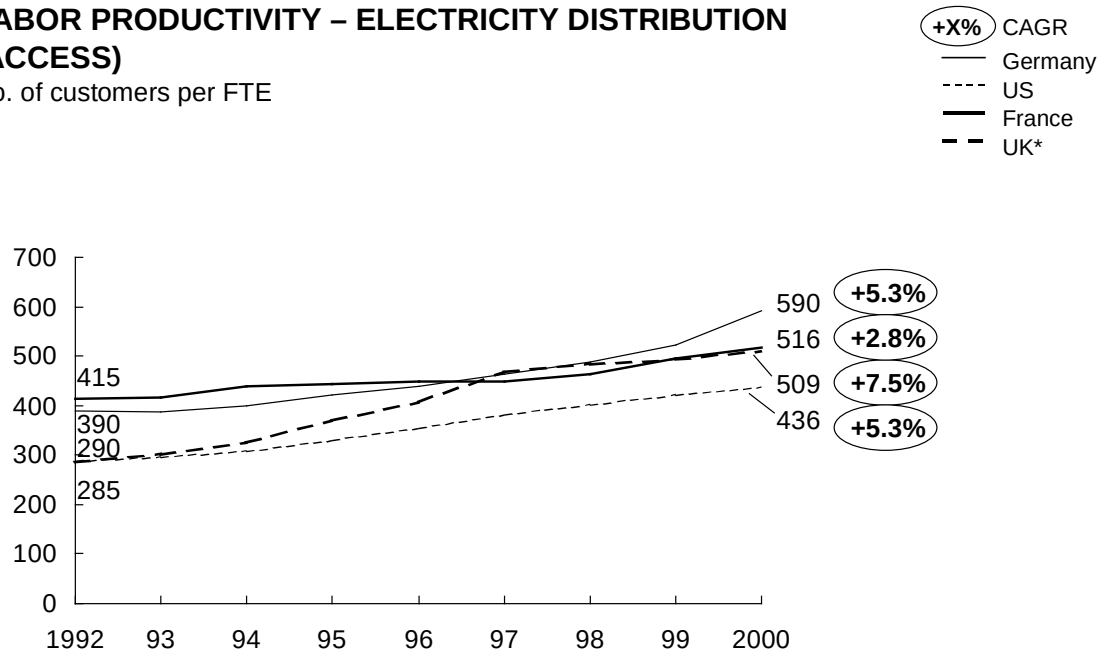
* England and Wales
Source: MGI analysis

¶ *Labor productivity: access* – The UK again achieved the highest growth with 7.5 percent a year, followed by Germany and the US (both at 5.3 percent), and France (2.8 percent). Overall, the US lags behind in this group, with the UK, France, and Germany having levels 18, 19 and 36 percent ahead of US productivity levels, respectively (Exhibit 19).

Exhibit 19

LABOR PRODUCTIVITY – ELECTRICITY DISTRIBUTION (ACCESS)

No. of customers per FTE



* England and Wales

Source: MGI analysis

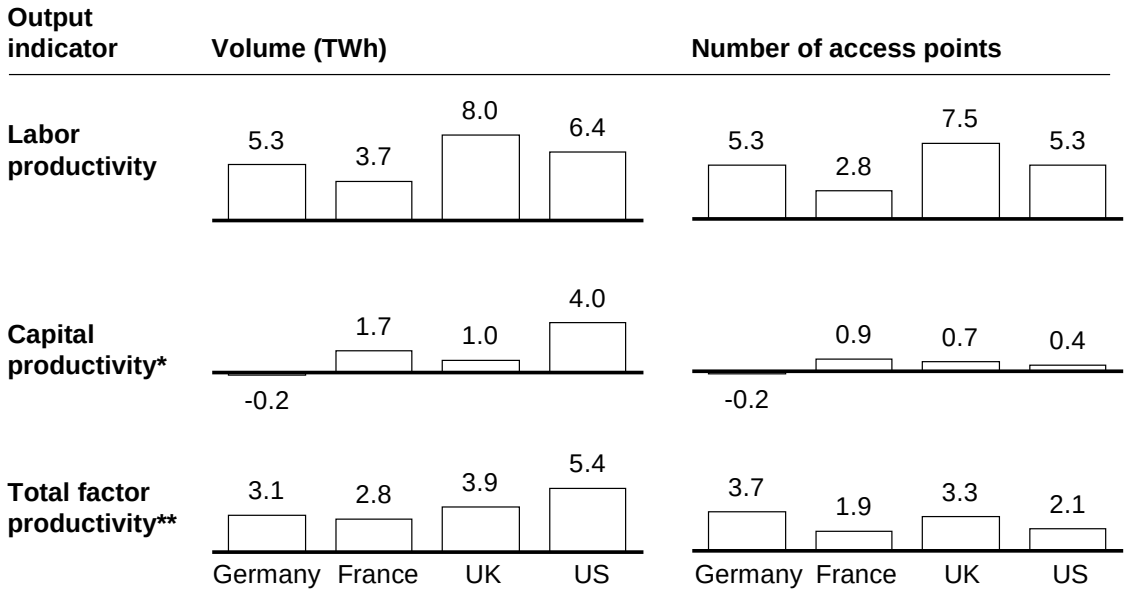
Capital productivity

France, the UK, and the US all showed positive capital productivity growth rates. Only Germany showed a slight reduction in capital productivity, although the figure was too low to be statistically significant (Exhibit 20).

Exhibit 20

PRODUCTIVITY GROWTH – ELECTRICITY DISTRIBUTION

CAGR percent, 1992 - 99



* Rough estimate based on IO data for the US, and England and Wales for the UK, based on German prices

** Rough estimate based on estimated capital productivity and average share of cost, TFP calculated as TFP = $(LP)^{\alpha}(CP)^{\beta}$ with $\alpha = 0.65$, $\beta = 0.35$

Source: MGI analysis

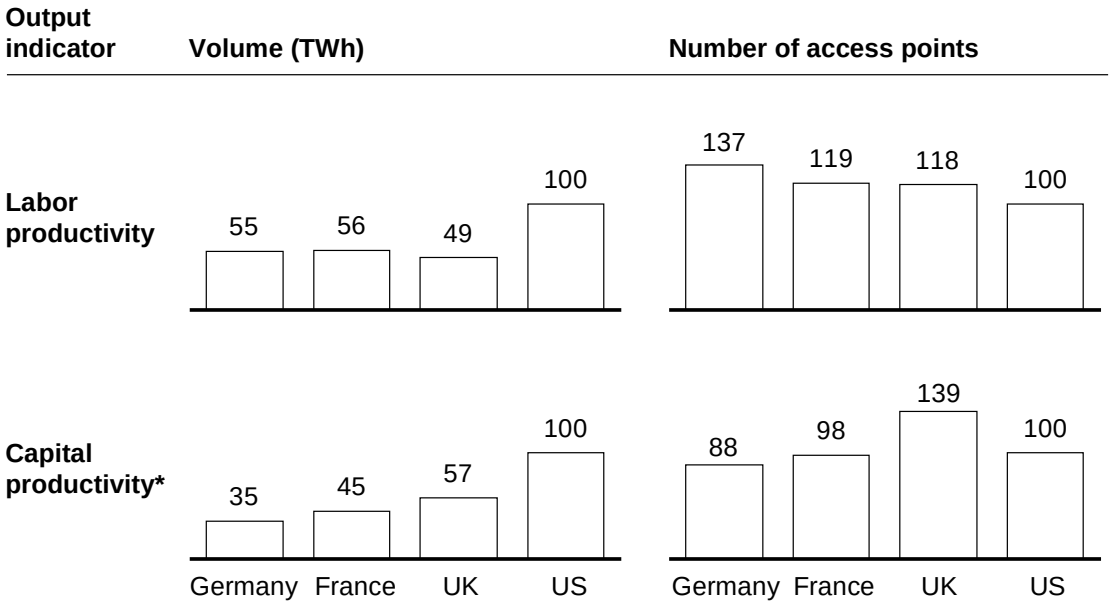
As a result, growth patterns in total factor productivity were similar to those in labor productivity, with the US having the highest growth rates and France lagging behind. However, the gaps in TFP growth performance were smaller, due to France achieving slightly higher capital productivity growth rates. This was partly because Germany was forced to invest more in infrastructure in the 1990s (e.g., the technological upgrade of the outdated East German network after reunification).

For productivity levels based on volume, the differences in capital and labor productivity showed similar patterns in each case: The US was more than twice as productive as France and Germany. In terms of productivity based on the number of access points, the pattern changes. All the European countries had a labor productivity advantage but, in capital productivity, the US was ahead of Germany and France but lagged behind UK levels (Exhibit 21).

Exhibit 21

PRODUCTIVITY LEVELS – ELECTRICITY DISTRIBUTION

Index 100 = US level 2000



* Rough estimate based on IO data for the US, and England and Wales for the UK, based on German prices

Source: MGI analysis

DRIVERS OF LABOR PRODUCTIVITY GROWTH AND LEVEL DIFFERENCES

We examine separately the firm-level factors and industry-level factors that determine the differences in labor productivity.

Firm-level ("operational") factors

The growth of labor productivity in electricity distribution during the 1990s was driven by an increase in the customer base and an increase in the volume consumed per customer. Companies also managed to reduce their labor inputs through labor-force reductions and outsourcing.[6]

Economies of scale. Economies of scale have had a clear influence on labor productivity in the 1990s. Both the volume distributed per customer and the customer base grew, helping companies to use their workforce more productively. Dis-

6 Please note: Outsourcing itself is not counted as a productivity increase, only a productivity increase of outsourced solutions versus in-house solutions enters the productivity measures.

aggregating the productivity number shows that the electricity consumed increased only slightly during the 1990s. The volume distributed in Germany grew by 0.7 percent a year and in France by 2.0 percent. In Germany this increase can be explained fully by the increase in customers (also 0.7 percent a year); in France 1.2 percentage points can be accounted for in this way, the rest being accounted for by an increase in consumption per customer. Per capita consumption increases directly drive volume-related labor productivity, as an increase in average consumption has only a marginal impact on staffing requirements. The increase in the customer base has less impact on access-related labor productivity, as new access points do partially drive higher staffing levels.

Reduction of overstaffing. While consumption increased, the number of employees was reduced by 4.4 percent a year in Germany and 1.6 percent in France. The UK managed to reduce its electricity distribution labor force by 6.2 percent a year, giving a total labor reduction of 41 percent from 1992 to 2000.

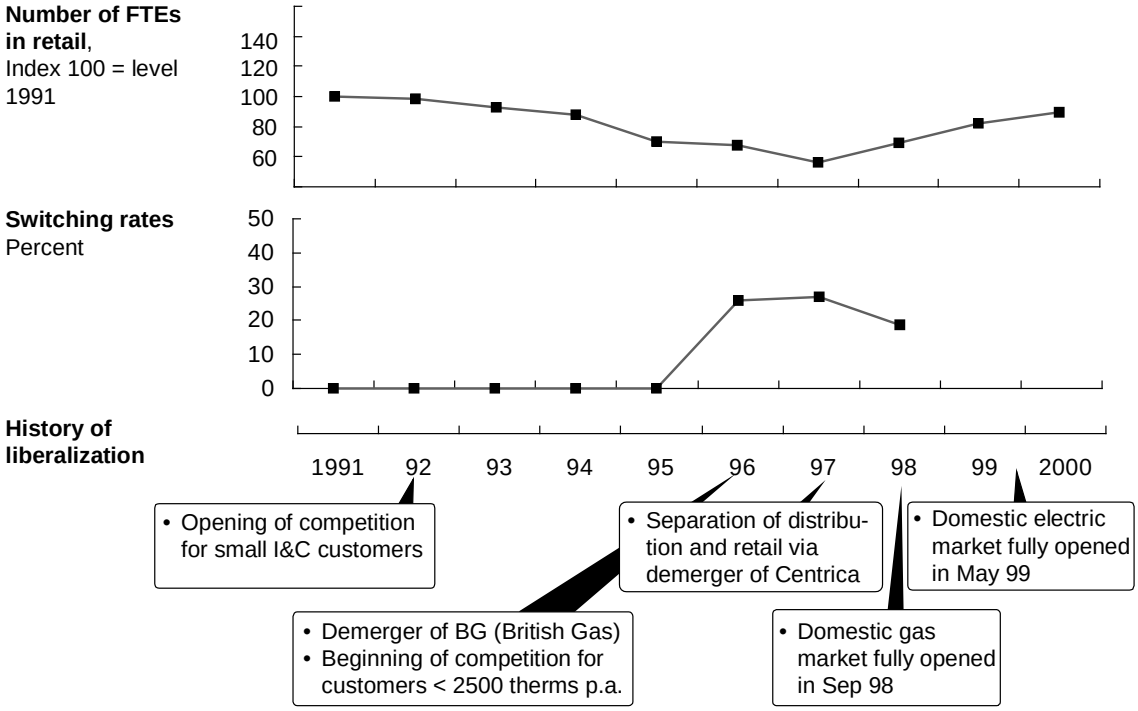
The exception here is EdF, which was not able to cut its workforce at the same rate as the other countries. In fact (together with Gaz de France), it actually slowed down its workforce reduction efforts due to political intervention, keeping employment at 10,000 workers above the intended level, most of whom were in the distribution business.

Outsourcing of services. Outsourcing to highly specialized and more labor productive companies increased substantially over the 1990s, especially in the UK and the US, but also to some degree in Germany. Metering and billing, some aspects of network maintenance, and call centers for retailing activities are all services that are increasingly provided by external service providers.

The full effect of these efforts was, however, balanced by the need to prepare for a market-based customer approach and the buildup of capacities for customer care and trading systems. In the UK, for example, the number of FTEs in retail decreased only slightly after liberalization began and switching of customers became possible. Companies extended their retail activities, building up new functionalities, such as customer acquisition and CRM. In gas distribution (a similar case to electricity distribution, see Box 2), the number of employees in the retail part actually increased after liberalization started; similar developments might be expected for electricity distribution (Exhibit 22). As a consequence, the growth in labor productivity in the electricity sector during these years was mainly the result of improved productivity in the transmission and distribution network. National network companies faced strict regulation with clear incentives for productivity increases. They raised productivity substantially through tailored investments and better management. Retail activities contributed only a small share of the improvement. In the UK, for example, 6 percentage points of the 7.5 percent CAGR is explained by productivity growth in the network part of the electricity sector.

Exhibit 22

LABOR PRODUCTIVITY – GAS RETAIL (UK)



Source: MGI analysis

Industry-level and external factors

Liberalization, privatization, and changes in the regulatory framework all affected electricity distribution in France, Germany, and the US. The reform of what was initially an entirely regulated electricity distribution sector was the major driver for the development during the 1990s. In addition, productivity numbers based on access or volume were driven by specific external factors such as average volume consumed per customer, network layout, customer density, or local market structure.

Regulatory framework. A wide variety of regulatory models have been implemented, with varying degrees of success, highlighting the need for smart regulation to achieve satisfactory productivity performance.

Overall, the UK underwent the most radical changes, moving towards a highly competitive structure in retail and a tight regulatory frame for network operators; labor productivity improved significantly, mainly as a result of the latter. France, on the other hand, continued to partly protect its sector against competition and tighter network regulation. This was one reason why productivity improved only slightly in France and it lost its leadership position.

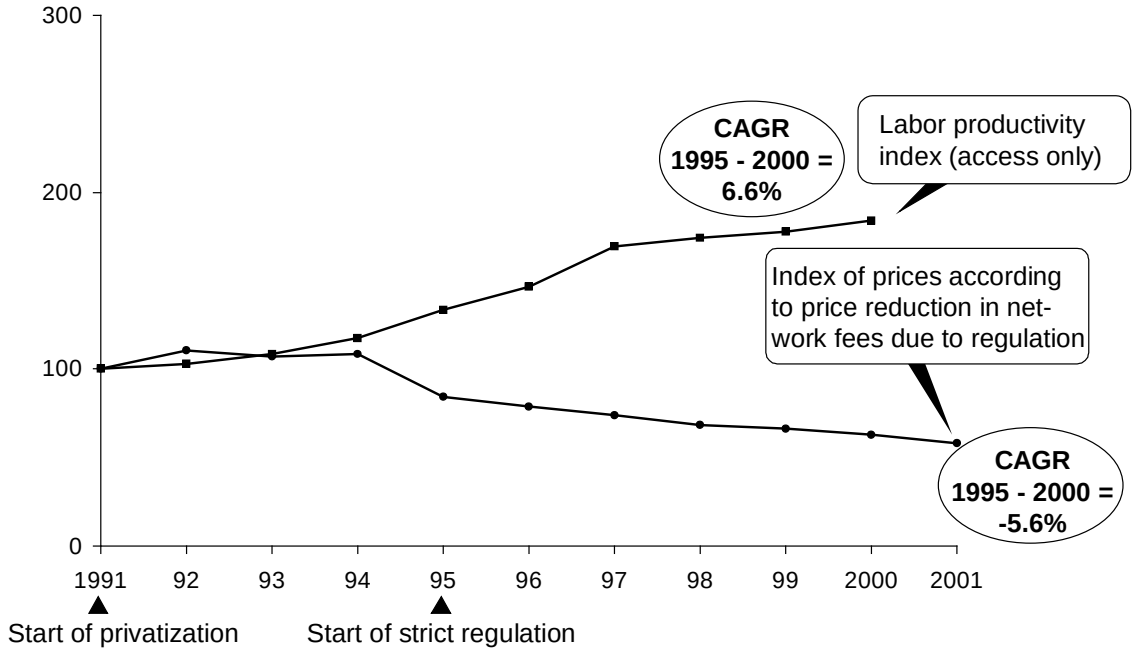
¶ *UK* – Liberalization of the market started in 1990 with the "Electricity Supply Act". This enforced the unbundling of the value chain and ensured that transmission was the responsibility of separate companies. All regional electricity companies were privatized. By 1998, both retail and industrial customers had complete freedom of choice.

Third-party network access was relatively fair and transparent. The UK introduced the RPI-X (retail price index minus x) regulation in 1995, which was supported by regular price control and extraordinary price cuts for distributors at predefined dates. The regulator forced network operators to reduce prices by up to 30 to 40 percent during the 1990s and announced additional severe cuts at the beginning of 2000. As a result, the increased efforts of distribution companies to compensate for the revenue losses by increasing productivity ensured that the labor productivity index went up by 6.6 percent a year from 1995 to 2000 (Exhibit 23).

Exhibit 23

REGULATED PRICE CAP AND IMPACT ON LABOR PRODUCTIVITY IN ENGLAND AND WALES, 1991 - 2000

Index 100 = US level 1991



Source: MGI analysis

Following these regulations, competitive intensity increased – even more so once the deregulation of the gas market allowed gas retail companies

to enter the electricity retail business. Wholesale[7] and retail prices fell significantly and the rates at which customers changed providers rose to as high as 25 percent in 1998. The resulting pressure drove operational improvements, as well as market consolidation: Distributors merged and third-party providers consolidated functions across the value chain of different distributors.

The regulator also forced the distributors to improve the quality of the supply, leading to a fall in the minutes lost per customer, i.e., time of no supply, by more than 60 percent during the 1990s.

¶ *Germany* – Regulatory change was less aggressive in Germany. Liberalization only started in 1998 with the "Act on the Supply of Electricity and Gas" which gave industrial and retail customers complete freedom of choice of electricity providers. For generation and transmission, account separation was introduced.

Third-party access was negotiated but there were serious limitations to the transparency of access and pricing. No dedicated regulatory body controlled third-party access. Instead, both access and pricing rules were negotiated by associations of suppliers and industrial users and fixed in association agreements. The first association agreement of May 1998 turned out to be inadequate for the establishment of a liquid and functioning market. It was renegotiated and the "Associations' Agreement II" was agreed upon in December 1999. This led to a large increase in transactions and made the establishment of two power exchanges possible. However, transparency in network pricing and variance in network price levels remained low across Germany. The amended "Association Agreement II plus" from December 2001 and its appendices from April 2002 tried to address these issues by introducing structural classes of network operators for price comparison reasons and by allowing for price review processes to be launched in specified situations. Impact of these changes still remains open as full implementation is expected from beginning of 2003.

Due to the late start of reforms, competitive pressures were still increasing at the end of the 1990s. Prices fell significantly for wholesale and industrial clients. For mass-market retail clients, they stayed stable, partly as a result of the increased environmental taxation. Switching rates also stayed low in the mass-market retail segment.

Nevertheless, as a result of anticipating further liberalization, distributors had already begun to implement operational productivity improvements.

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[7] Current discussion on financial crash of British Energy (generator) and potential impact from regulation not included in this report. The UK development is mainly regarded from the distribution perspective.

The preparation for the European single market also led to some mergers although consolidation had a much lower impact on productivity than it did in the UK.

¶ *France* – France successfully protected its market against competitive pressures and tightening regulation of the network, as was demanded by EU regulatory bodies. EdF was allowed to keep electricity generation and distribution integrated (without the high voltage part); account separation was only introduced in 2000. In line with EU legislation, free choice was introduced in February 1999 for clients with consumption levels above 100 GWh (in February 2000 for clients above 16 GWh), who account for 30 percent of national supply volume but only a minor fraction of customers.

For much of the 1990s, third-party access to the network was not regulated (as is now the case), leaving room for EdF to build up serious barriers to entry for new distributors. New entrants complained, in particular, about the lack of responsiveness to their applications for network access. It was only in 2000 that the publication of tariffs for eligible customers' access to the network started to create the first steps towards greater transparency.

The lack of competitive pressures, continued state intervention, and a comfortable starting position all led to the stagnation of productivity levels within electricity distribution. The labor productivity growth initiated within EdF was strongly affected by the obligation from the French government to hire 10,000 employees, thereby reducing overall productivity growth by 1.2 percentage point a year for the full period. This meant that France lost its advantage in this area and, in 2000, Germany was performing slightly better than France, despite being far more fragmented, and not having the benefits of economies of scale.

¶ *US* – Liberalization and deregulation started in the second half of the 1990s, but progressed very slowly. As the utilities sector decentralized, liberalization took place state by state. By the end of 1999, only 11 states had liberalized their retail trade; today this total has risen to 24.

Network regulations in most states restrict the return a company is allowed to make which, in turn, affects prices. This regulation gives stability to the business but also provides little incentive to improve efficiency, as any benefits have to be passed on directly to the consumers.

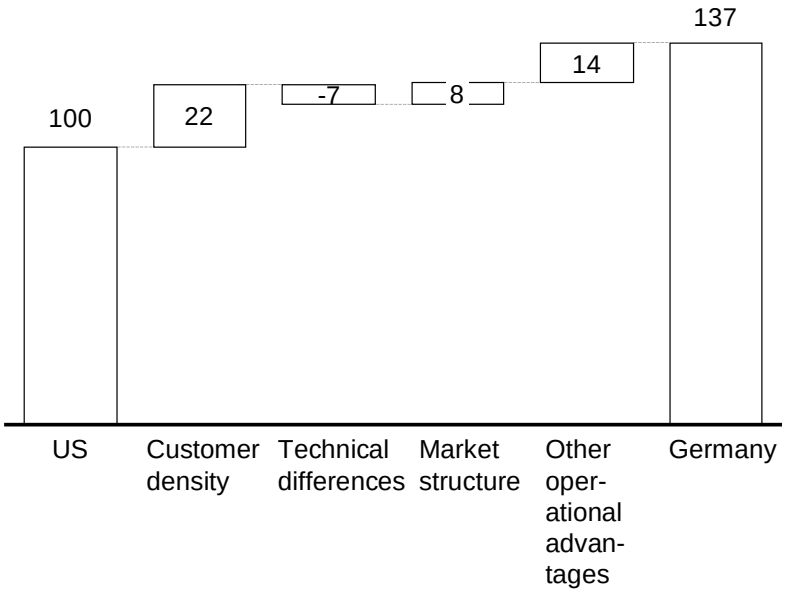
Volume- or access-specific external factors. Although productivity levels in Germany, France, and the UK converged during the course of the 1990s for both volume and access output measures, the gap with the US productivity levels continues to be substantial. For labor productivity measured by volume, France and

Germany are about 45 percent behind the US, but for productivity measured by access, France is 19 percent ahead of the US level, and Germany is 37 percent ahead.

¶ *Labor productivity: access* – When comparing Germany and the US, 22 percentage points out of the 37 percentage point German advantage can be explained by the use of more efficient processes caused by its higher customer density. Shorter lines per customer simplify network construction and maintenance efforts for the network. Another 14 percentage points can be attributed to higher operational efficiency in Germany; a further eight percentage points is due to differences in market structure (e.g., the higher share of consumption by industry customers in Germany, as compared to household customers). Finally, technological differences in the setup of the networks explain a seven percentage point disadvantage of Germany compared to the US (Exhibit 24).

Exhibit 24

LABOR PRODUCTIVITY IN ELECTRICITY DISTRIBUTION (ACCESS)
Access per FTE, index 100 = US level 1999



Source: Interviews, MGI

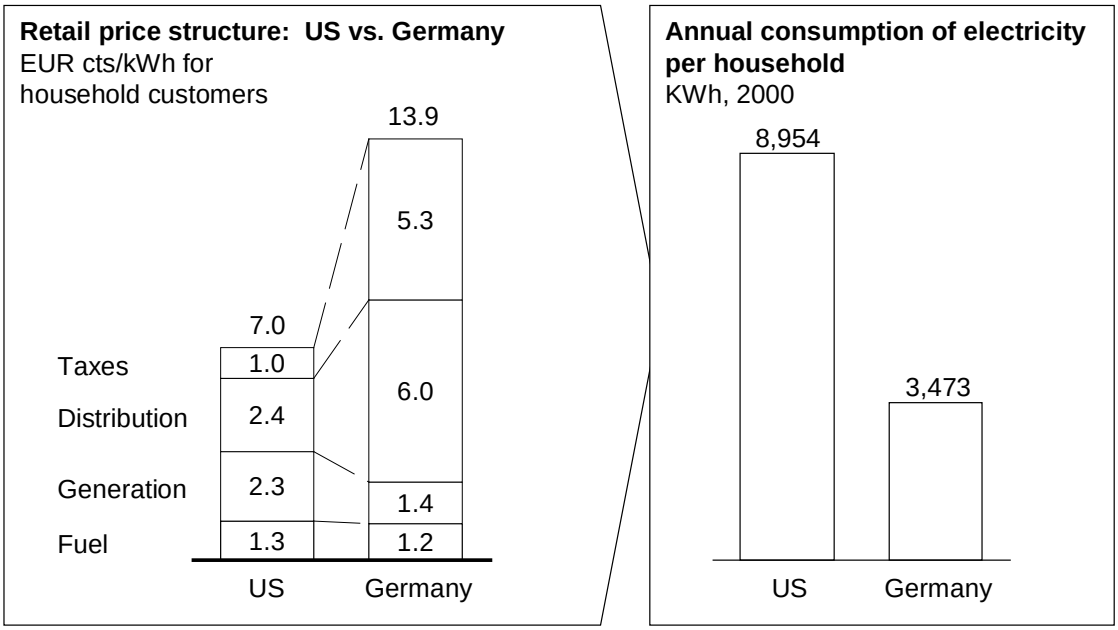
¶ *Labor productivity: volume* – The US disadvantage in access-related productivity is balanced by an advantage in volume-related productivity, the US being twice as productive in this as France and Germany. This strong advantage means that the US is ahead in the aggregated labor productivity index. Most of this advantage is simply explained by higher

average consumption: Annual electricity consumption per household in 2000 in the US was more than double that in Germany (Exhibit 25).

Exhibit 25

COST STRUCTURE OF RETAIL PRICES FOR HOUSEHOLDS IN THE US AND GERMANY IN 2000

ESTIMATE



Source: EIA, expert interviews, MGI analysis

Differences in environmental policy also play a role in consumption habits, with political regulations in Germany, such as housing insulation standards, seeking to reduce energy consumption.

ROLE OF INFORMATION TECHNOLOGY IN UTILITIES

IT expenditure grew at impressive rates over the 1990s. In France, the utilities sector increased IT investment by 7.5 percent a year; in Germany, it increased at 8.0 percent. Estimates indicate that about 20 to 30 percent of that spending was aimed directly at increasing both labor and capital productivity. IT was used to improve operational planning and asset management, streamline metering and meter handling, and improve enterprise resource planning systems. As most of this expenditure went into distribution with only a fraction devoted to generation, MGI covers it as part of the distribution analysis.

In addition to this direct impact, IT also had an indirect effect by aiding the migration of a highly regulated sector towards a liberalized market with a competitive and decentralized industry structure.

- Interface management and settlement systems became important as the unbundling of the value chain had to be reproduced in the IT systems and the flow of information between the separate components of the value chain had to be secured.
- Retailers had to build capacity for customer acquisition, customer service, and billing systems. Billing became more complex, as different pricing schemes allowed personalization of bills, and separate billing for the network and the volume consumed was required.
- Management Information Systems had to be configured to fulfill regulatory requirements for the data that was to be exchanged and monitored.
- With increasing merger and outsourcing activity in the sector, IT systems had to be aligned with each other to guarantee the efficient exchange of information.

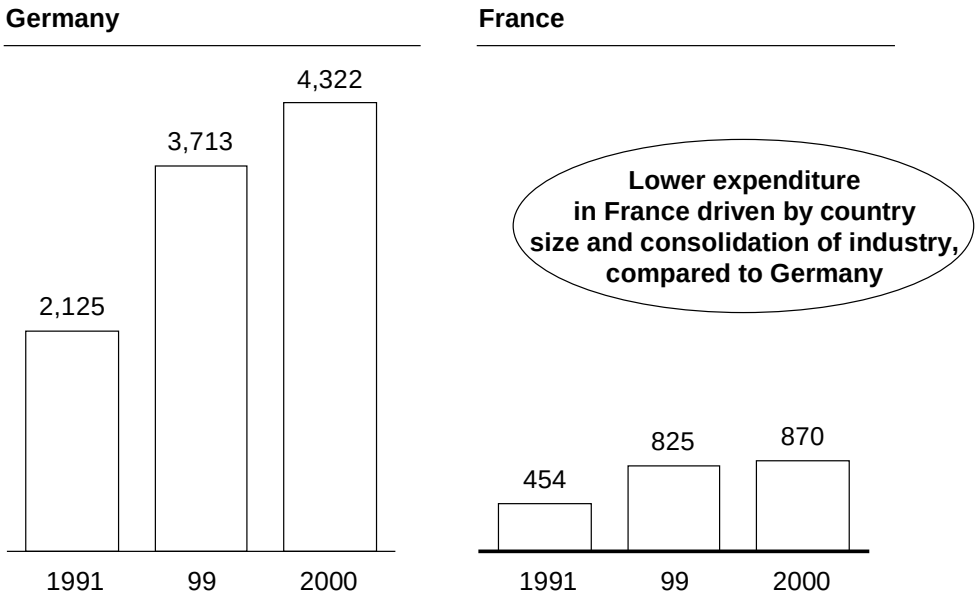
Although these factors drove productivity directly, or enabled the migration to a new industry structure, they were not the only source of IT expenditure and also do not explain intra-country differences in the size of expenditure.

- Germany's total IT expenditure exceeds France's by a factor of five. This is due to the fragmentation of the German utility industry and the consequent need to build up systems for a large number of independent companies (Exhibit 26).

Exhibit 26

IT TOTAL EXPENDITURE EVOLUTION IN REAL TERMS

EUR, base year 2000



Source: PAC 2002, PAC 2001, National deflators, OECD ICT harmonized deflator

¶ Exceptional events, such as Y2K and the introduction of the Euro, in addition to merger-related IT expenditure, explain a major part of the increase in IT expenditure at the end of the 1990s (Exhibit 27).

Exhibit 27

GOALS AND OBSERVED IMPACT OF IT IN UTILITIES – GERMANY

ESTIMATE
● High impact
○ No impact

Main goals	IT initiatives	Increase in productivity: Labor	Increase in productivity: Capital	Increase or stabilization of profitability	Evaluation of possible overinvestment and future potential
Operational excellence	• Operations planning • Asset management • Metering and meter handling • ERP • E-enabler of HR • Outsourcing	◕	◔	◕	• Lower investments in the past • Primarily related to cost reduction plans
Effectiveness of marketing/ sales force	• Customer care and billing	○	○	○	• Negative impact on productivity and profitability as indirect sunk cost of enabling competition
New products, services, and business	• Trading systems	○	○	◑	• Sunk costs indirectly due to new competitive rules in the utilities market
Extraordinary events	• Mergers	◔	○	◕	• Necessary investments for synergy capture
Renovation	• Aligning business and IT strategy • IT funding and governance	○	◑	○	• Normal investments that will continue
Regulatory requirements	• Liberalization/business separation	○	○	○	• Sunk costs that could be discussed with regulators

Source: MGI analysis, PAC

¶ About eight percent of the overall investments were necessary for regular business renovation to existing systems.

Many of the IT investments of recent years were necessary for the transformation of the sector and this investment might continue to some extent as the transformation of the sector has not yet reached its final state or, in the case of France, even begun.

OUTLOOK AND RECOMMENDATIONS FOR THE SECTOR

Productivity growth rates in Germany are likely to be sustained over the next few years, as most of the effects of the operational improvements have not yet been realized. For electricity distribution, the major share of this growth will be driven by an increase in network productivity.

Whether France is forced to realize its improvement potential will depend on the domestic political will and, internationally, on the degree of pressure from the European Union and the increasing competitive pressures of the European market.

In the US, higher growth is expected as the liberalization of retail activities and the regulatory changes in the network that are only just beginning in some states, are expected to be implemented across all the states over the coming years.

Productivity growth has already slowed in the UK from the extraordinary rates seen in the 1990s. Now that the core reorganization processes have been implemented, the UK is likely to return to more moderate productivity growth rates. This, in turn, might have consequences for the network regulation in the sense that the RPI-X development might have to be adapted to the decreasing productivity growth potential as compared to the 1990s.

Future regulatory reform in the sector – especially in network access – will have to ensure that economically viable solutions are combined with incentives to improve performance. Previous cost-plus regulation – as seen in Germany's network distribution – did not prove to be the most effective regulatory scheme. A decreasing price cap, as used in the UK's network regulation, proved successful in improving productivity. Regulators will continue to play an important role in preventing anti-competitive behavior. They need to ensure that network providers provide the highest degree of transparency for both pricing and the conditions of access for competitors.

Box 2 – Development in gas distribution

Many distribution companies engage in both gas and electricity distribution. However, as each subsector is subject to a different regulatory environment it is instructive to look briefly at gas distribution.

Definition and methodology. *The gas distribution sector comprises the transmission and distribution network operations and all retail activities. Labor productivity was measured using both the number of points of access per FTE and the gas volume distributed per FTE. France, Germany, the US, as well as the UK, were analyzed. Aggregate productivity levels were not included.*

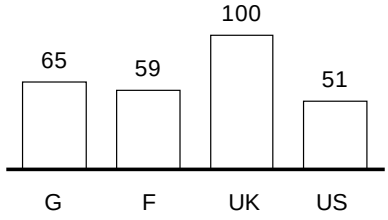
Overview findings. *The UK's labor productivity growth, based on volume (11.9 percent CAGR), outperformed the other countries. Based on access, Germany and the UK with 7.5 and 6.8 percent CAGR, respectively, outperformed France and the US (Exhibit 28). By the end of the 1990s, the US and the UK led on volume-based labor productivity (Exhibit 29); the UK led on access-based productivity (Exhibit 30). France lagged behind significantly on volume-based productivity, and the US on access-based.*

Exhibit 28

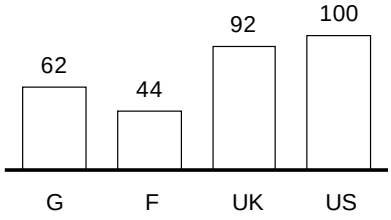
PRODUCTIVITY GROWTH AND LEVELS – GAS DISTRIBUTION

Labor productivity level

Output = no. of customers,
index 100 = UK level 2000

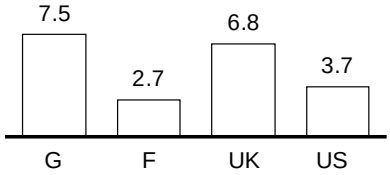


Output = volume [TWh],
index 100 = US level 2000

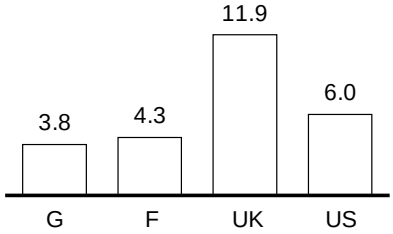


Labor productivity growth

Output = no. of customers,
CAGR percent, 1991 - 2000



Output = volume [TWh],
CAGR percent, 1991 - 2000

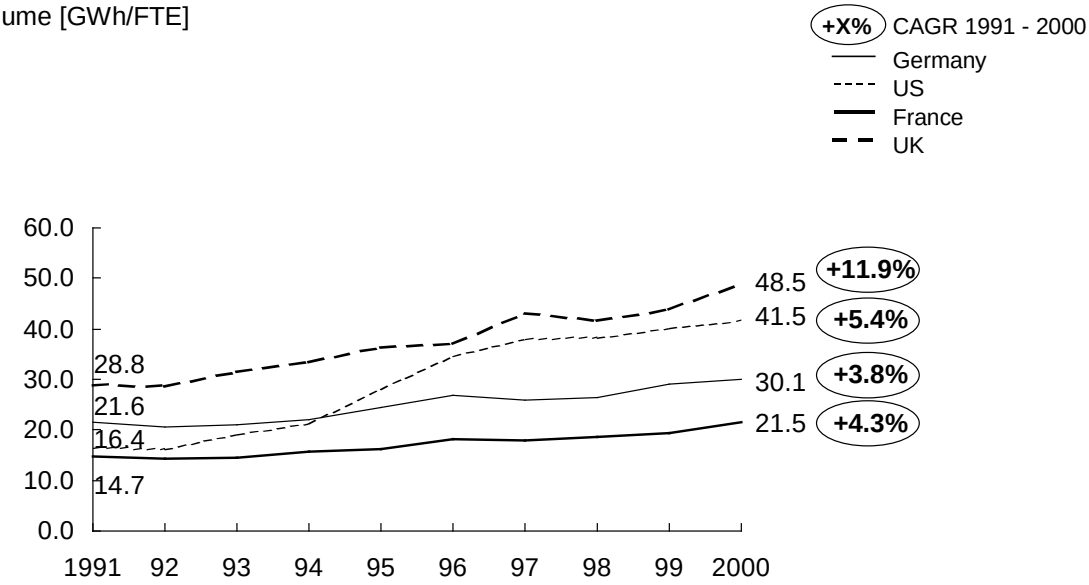


Source: MGI analysis

Exhibit 29

LABOR PRODUCTIVITY – NATURAL GAS DISTRIBUTION (VOLUME)

Volume [GWh/FTE]

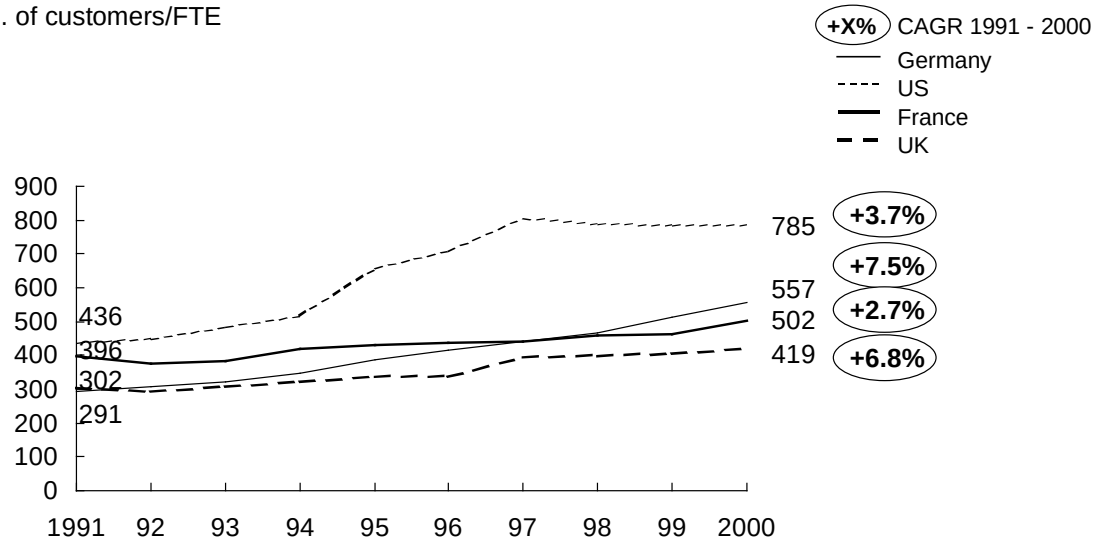


Source: MGI analysis

Exhibit 30

LABOR PRODUCTIVITY – NATURAL GAS DISTRIBUTION (ACCESS)

No. of customers/FTE



Source: MGI analysis

Causality. *Regulators usually separate the gas and power distribution sectors, which means that deregulation has historically followed a different path in each sector. In England and Wales, the liberalization of gas distribution started earlier than that of electricity, while in France and Germany it did not begin until 2000, although some of the changes in electricity distribution did percolate into its "twin" industry.*

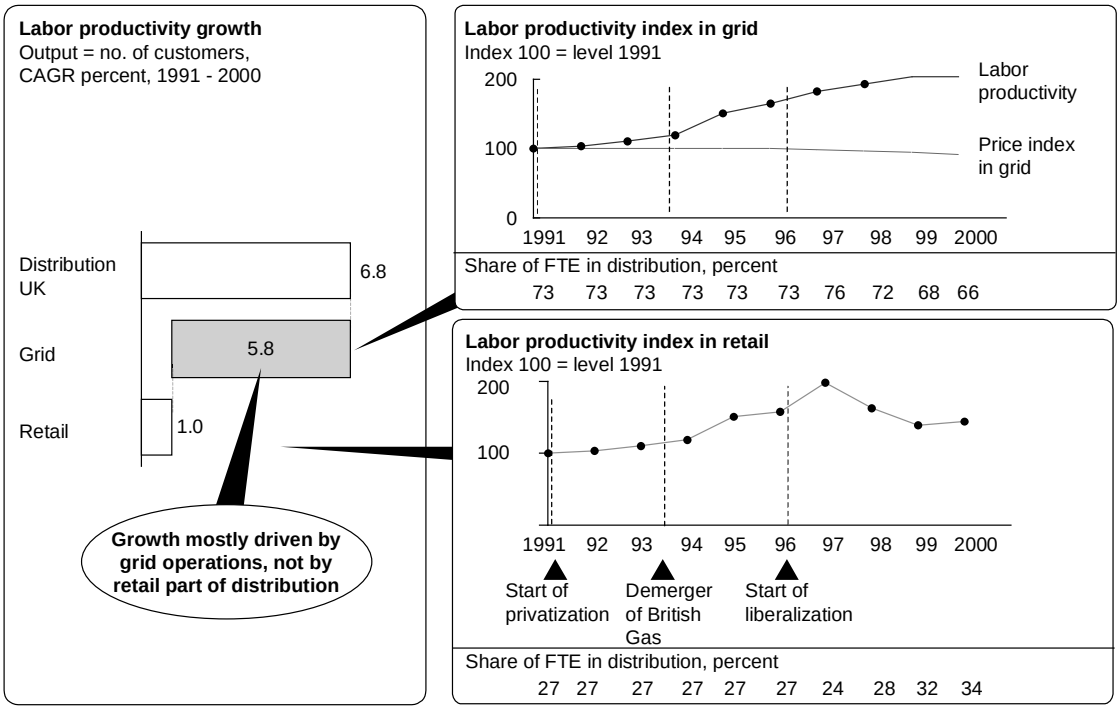
UK. *Labor productivity reached peak growth rates of 6.8 percent CAGR in terms of access per FTE measurement, and 11.9 percent in terms of volume. Labor force reductions were substantial in the field of gas distribution: Labor was cut by 36 percent in ten years, with network distribution down by 45 percent. Along with the reduction of overemployment, this was due to increased outsourcing and a reduction of head-office labor following mergers and reorganization. While the labor force shrank, market penetration – already very high in the UK at the beginning of the 1990s – rose further during the decade. The UK gas distribution sector also benefited from the switch towards gas-fired power plants in power generation: As much as 4.2 of the 5.6 percent CAGR of total growth in consumption was driven by new gas-fired power plants.*

In separating network activities from retail, it is clear that the regulation of network activities led to a considerable operational improvement in labor productivity (through specialization, economies of scale, and the rationalization of tasks),

while the introduction of activities such as customer care and call centers in retailing led to reduced growth rates and, even, to periods where there was no productivity growth in retail. Labor productivity initially fell as new staff were hired to implement these retail programs. Once installed, the hiring stopped and firms were able to reduce the labor force in these new activities (Exhibit 31).

Exhibit 31

CONTRIBUTION TO UK GAS DISTRIBUTION PRODUCTIVITY GROWTH FROM GRID AND RETAIL



Source: MGI analysis

Germany. *The high growth rate of Germany's customer base (5.8 percent CAGR) was mainly due to the connection of East German city gas customers at the beginning of the 1990s and to a real effort to increase market share of gas by customers switching from oil to gas. Over this period, the market penetration of gas expanded from 29 percent to 45 percent of households. Gas deregulation only began in earnest in 2000, so it has the potential to yield further productivity improvements. The deregulation model is built on an agreement between utilities and customers but without the oversight of a regulatory body. It remains to be seen whether this will actually create efficient competition in the gas market and will be able to drive increased productivity.*

US. *The US customer base fell during the 1990s and the overall improvement in gas labor productivity, based on volume, was mainly due to deliveries of new gas-fired power plants.*

France. *During this period, the number of newly-connected households added to the distribution network was far higher than the actual number of new customers. Although the official figures show that 18 million households were newly connected to the gas network, figures issued by GdF and other minor gas suppliers showed that they added only ten million new customers. This suggests that the companies had paid for new connections without actually gaining the connected households as customers. Part of this underperformance is related to the political and marketing advantages that electricity has over gas in France. Productivity growth in the French gas-distribution sector slowed perceptibly in 1997 due to political pressure on EdF and GdF not to strive for additional decreases in employment (see electricity distribution). Given that the opening of the gas market only started at the very end of the 1990s, no real impact from deregulation has yet been realized.*

Outlook and recommendations. *Gas utilities are still under pressure, so continued improvements are expected. The growth rate in Germany is likely to be sustained in the near future as most of the effects of the operational improvements have not yet been realized. In the UK, the productivity growth rate could continue to decline as the core process of reorganization is already over. In the US, higher growth can be expected as the liberalization of retail activities is only just starting, with little impact as yet. France has not shown an increase in operational performance and is beginning to be put under increasing pressure, not only by the performance of other European countries but also by the European Commission. However, no clear signal has been given that there will be further efforts towards improving labor productivity.*

***

METHODOLOGY

Although national statistics are based on value added per unit of labor (currently employees or total wages), MGI chose to compute labor productivity on the basis of physical measurements, as this allows a direct international comparison of sector performance – avoiding value-conversion problems between different countries. Physical measurements take units of energy as output instead of "PPP-adjusted real Euros".

Because the industry is highly capital-intensive, MGI computed capital productivity and fuel productivity for the power-generation subsector. Though productivity in generation is mainly driven by fuel and capital, the key lever of improvement, besides drastic innovation, is, nevertheless, labor. For distribution, labor is the most important cost driver.

As the EIA and IEA both publish internationally comparable physical data, including technical data for causality analysis, the energy sector is quite well documented, especially in electricity generation. For gas and electricity distribution, MGI obtained national data from the sector's private companies and industrial associations, such as VDEW in Germany and Platts in the US, or from government units, such as DIGEC in France, and regulators, such as OFGEM in the UK. For both subsectors, MGI based its analysis on internal databases and corporate knowledge.

For labor, we based FTE data on national statistics, supported where necessary by private data. The correction for annual holidays and hours worked per week is based on the European labor force survey and BLS equivalent data.

Electricity generation

For labor productivity, the output is defined as the amount of TWh produced (and then distributed, exported, or resold). International agencies such as the EIA provide comparable figures, which may differ from official national figures.

Labor input is measured by the internationally comparable full-time equivalents. MGI corrected official FTE figures by a factor that takes account of international differences in working hours per week, as well as the number of days taken off per year. Ideally, differences in the average number of sick days in each sector and country should be corrected to reflect an index of real equivalent hours worked, however, no reliable data is available and the overall effect on results would be minimal. Labor productivity is calculated as output divided by input, generally indexed against the US (equal to 100).

Capital productivity is also based on physical measurement and the output is, therefore, the same as for labor productivity. The input computation is based on the Perpetual Inventory Method, assuming a different lifetime for each type of power plant based on expert interviews and various external reports. The results were based on detailed investment per power plant type per country, although there is unfortunately no single source of information. DIGEC supplied the data for France, the EIA for the US, and the *Handbuch der Elektrizitätswirtschaft* (2000) for Germany.

The cost of each power plant needs to be adjusted by Purchasing Power Parity (PPP) to take account of local market-price differences, for which management cannot correct (such as legal constraints), and market-structure differences in the upstream industry. The adjustment factor is very small (3 percent in favor of Europe) as most of the price differences are caused by goldplating (i.e., the design exceeds the technical requirements), and for price discounts for large purchases, as is the case for nuclear power plants in France.

Fuel productivity was important in the analysis, as some trade-off could have been made between labor, capital, and fuel costs.

MGI opted for a consistent physical measurement that reflects management's decision to install more or less efficient capital assets.

MGI based its fuel productivity input on the amount of energy converted into output, giving an average efficiency rate per country.

Electricity distribution

In electricity distribution, there is vigorous debate about the definition of output. MGI opted for the computation of two measurements. The first takes the volume of energy delivered (after losses) to customers, while the second takes the number of connections to the network (access). Although volume is an indicator of customer value, the number of connection points reflects the amount of real work for the company, in terms of both network maintenance and retailing activities.

For both output measurements, MGI corrected the output for quality of supply. We took the simplest indicator, power outages, and applied the "value of loss load" method, taking the OFGEM (the UK regulator) figures, updated by inflation rates, as an indicator of willingness to pay by customers, industry, and services. The correction is not important in the final analysis but seems to reflect the real situation, as shown by cross-checking with recent studies concerning the sensitivity of customers to outages. Output is not corrected for losses within the distribution network, as these are additional cost factors for distributors.

FTE input follows exactly the same definition as the measurement of labor productivity in electricity generation.

Gas distribution

Output was defined, as for electricity, by both the volume of gas delivered in TWh and the number of connection points to the network. The labor input is FTE corrected according to the same factors as in electricity. For reasons of data availability, capital productivity for gas was not computed and no quality correction was performed, as "gas outages" do not play a significant role.