# BergmannKohler Power and Gas

## Innovation and the Big Data Dilemma

**PREFACE**

As Bernhard Winkel stepped into the lobby of his office headquarters, he could hear an unusual sound coming from the parking lot. He was leaving the office after a long day, and had been looking forward to a well-deserved dinner, which he was to attend with some wealthy German politicos including the German Chancellor. As he approached the main entrance, the muffled sound was becoming clearer. There were at least fifteen people chanting in unison.

The security guard with whom Bernhard was well acquainted approached him. “Let me walk you out Mr. Winkel. It looks relatively peaceful, but you never know.” Bernhard agreed.

His driver had pulled his Mercedes-Benz S600 to the front entrance. As Bernhard exited the building, the ice cold air hit his cheeks and nose, and the sound of chanting filled his ears. “No more coal! No more coal!” was being echoed in unison. Bernhard’s driver was ready at the car’s rear door and ushered him in quickly. As they drove away, he could hear a few fists being pounded on the car’s backlight, but thankfully, the protesters did not try to pursue the vehicle on foot.

“Quite the dramatic scene” his driver exclaimed.

“Well, it comes with the territory. These are the issues I need to be aware of as the CEO of a major power company.” Bernhard Winkel was indeed the CEO of one of the largest power and gas companies in the world, BergmannKohler. In his upcoming dinner with the Chancellor, these were exactly some of the issues he anticipated discussing. At that moment it dawned on him that those protesters must have known that he had that dinner scheduled for tonight – a thought that made him uneasy. He sat in silence, staring out of the car window for the duration of the trip.

As they pulled in to the restaurant, Bernhard was starting to feel better. The Chancellor had chosen to meet at his favorite French restaurant, and Bernhard genuinely enjoyed the Chancellor’s company. As they sat down at the table along with two other cabinet ministers, the conversation revolved almost completely about the outlook for Germany in terms of power supply and leading innovation, as well as what the future looked like for the rest of Europe.

The Chancellor made it abundantly clear that Germany wanted to lead the way in terms of clean energy and set an example for the rest of the world. Local citizens were becoming more and more conscious of environmental issues, so utilities companies were going to feel the pressure to clean up their act. There were also economic factors at play. Since BergmannKohler was one of the largest businesses in Germany, the Chancellor made it clear that they would be fully supported by the cabinet, and that changes could be made gradually so as not to cause undue economic harm.

**Quick Facts**

Industry:
**Electric and Gas Utilities**

Geographic Scope:
**Global**

Headquarters:
**Berlin, Germany**

Number of Employees:
**72,000+**

Company Revenue:
**€132 billion (est. 2012)**

After dinner Bernhard was feeling good, but also realized that he had a lot of work to do. BergmannKohler was going to need to undergo not only a few small changes, but an entire *transformation* over the next 10 years. He knew that he could not come up with a plan on his own, and that he would need to rely on his consultants for guidance.

**Company Overview**

BergmannKohler is a global electricity and gas utility company. The following is a description of their history, their global reach, and the overall state of their industry.

*History and Global Reach*

BergmannKohler is historically a German company that got its start in coal power generation in the 1920s. They built the first industrial scale coal-fired power plant in Germany and were involved in key coal mining operations in that region. They were also responsible for developing a robust electricity distribution network throughout the nation, thus securing a relative monopoly on power in the country.

The company thrived in Germany through the first half of the 20$^{th}$ century, and in the 1950s they made the strategic decision to broaden their scope and expand into gas distribution for in-home heating. They did this by acquiring the largest liquid natural gas (LNG) company in the region, along with its distribution network. This acquisition truly solidified their power in Germany, providing jobs and accelerating modern living in the nation. It also allowed them to broaden their scope even further and secure acquisitions outside of Germany, in other areas of Europe, and also in differing energy sources including nuclear.

During the 1980s, as issues such as climate change and environmental degradation started to take hold, an expansion into renewable energy sources was inevitable for BergmannKohler. They began a three-pronged approach: 1) acquiring small and medium sized renewable power companies 2) taking on new-build projects of their own, including wind farms and hydroelectric power plants 3) investing in a number of research projects to help discover and optimize methods of generating renewable power.

This expansion into renewables also led naturally into their global expansion. While still procuring coal and LNG from a variety of locations around Europe, their primary drive for global expansion was to acquire, build, and distribute renewable energy around the world. As of now, they had ownership over a number of wind farms in the United States as well as a few solar power plants in that region. By and large, wind energy was driving their global expansion, and they did not want to stop in North America. Russia was also a key country of interest to BergmannKohler, as they were looking to partner with some LNG producers in that region.

*State of the Industry*

Bernhard Winkel knew that currently, the energy sector was facing a few fundamental changes. There were huge challenges in Germany and Europe, including increased regulation and political intervention, increased competition and pricing pressures, and a huge public concern about responsible energy generation and environmental effects. All of these things Bernhard took very seriously, and he knew that it would be a delicate balancing act to help operations run smoothly into the future. He needed to be concerned about the jobs his company could provide in the coal, nuclear, and LNG industries, while at the same time being committed to making positive changes towards better environmental protection. Any large scale transformation of the company would need to take place gradually so as to cause the least amount of disruption as possible.

The German government had already put a moratorium on nuclear power generation, which would require all of BergmannKohler's nuclear power plants to be shut down in Germany by the year 2022.

**Energy Mix and Operations**

Overall, in 2013, BergmannKohler owned a total generation capacity of 65 GW from worldwide sources. The breakdown of their energy sources is as follows, in order of greatest to least:

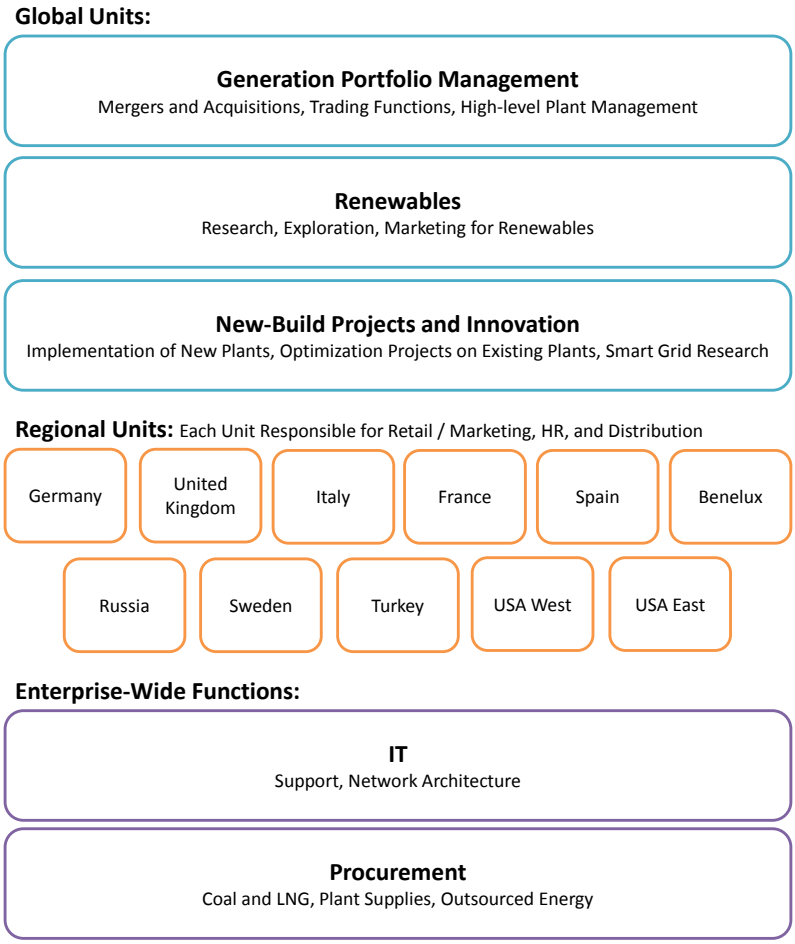
1. Natural gas (44%)
2. Hard coal (31%)
3. Renewables (13%)
    a. Wind
    b. Hydro
    c. Solar
    d. Biomass
4. Nuclear (12%)

All of their power plant operations came highly equipped with different types of monitoring equipment. For example there were numerous temperature sensors for their LNG operations, since temperature made a huge impact in the volume of the gas, thus affecting processing and transport. They had sensors on their coal burning engines to monitor the energy output at all times and also track the emissions. For their renewables operations, there were many pieces of data that came into play. For example, weather conditions could highly affect all of the renewables sources, so tracking weather conditions was vital. The ability to eventually predict local weather conditions accurately and then act accordingly was what they were hoping to be able to do in the near future. Ideal for marketing would be the ability to 'control the conversation' when it came to their power generation efforts and stay two steps ahead of the end consumer. Overall the current and potential incoming data from their operations was enormous and needed to be used to its full potential. BergmannKohler was part of the way there, but they would need some help to optimize this data usage across the organization.

Their energy production from coal and nuclear, as well as their LNG distribution, remained solely in Europe. Their renewables projects however, were globally dispersed, with over 4 GW of wind energy being farmed in the US and distributed locally through third party networks. Their procurement of LNG and hard coal was outsourced; BergmannKohler did not operate any upstream gas production facilities or coal mining operations – however they did partner with them. On top of this, since nuclear energy in Germany was being phased out, it would be vital to replace that lost capacity with a different source of energy production – it was unclear as to whether that would mean more investment in coal, or more renewables.

In terms of operations, the company had global units as well as regional units. There were three global units – generation portfolio management, renewables, and new-build projects and innovation. Functions such as IT and procurement operated on an enterprise level as well, but were not referred to as global units. The company was also broken down regionally, with eleven regional units governing Europe, the U.S.A., and Russia. Regional units were responsible for retail operations, marketing, and regional energy networks.

Below is a visual breakdown of the organizational units.




### Innovation and the Big Data Dilemma

One of the prominent new innovations in utilities was the idea of a smart grid, equipped with smart meters. Bernhard understood clearly that this was the direction that the industry was going in and that it was only a matter of time before the entirety of the modern world would have a foundation of smart power technology. As much as the hype had been built up, however, there were few regions in the world that had implemented smart grid technology without any major setbacks, and which had the technology in place long enough to establish any proven best practices around deployment and optimization.

Also on Bernhard's mind was the need to maintain a competitive advantage over China. The nation was quickly increasing its power usage at home, and there were sign that it was looking to expand abroad as well. Bernhard wanted to ensure that BergmannKohler remained a leading global player. In order to do this, he recognized that they had to lead in innovation, keep their operations lean and efficient, and be the most responsive to consumers. Given China's history of leap-frogging innovation, there was a good chance that they would try to champion the smart grid at home – in areas where there was currently little or no infrastructure.

The important distinction between a smart grid and a regular grid was that smart meters could send back data to the servers at the utilities companies every 15 minutes at least, as opposed to having a manual process where a person would come to a customer's house and check the meter once a month. There were also tools such as phasor monitoring units (PMUs) that could collect voltage, current, and digital status measurements as often as 30 times per second at many points along the grid.

The benefits of this data were undeniable. Not only would the increased readings from smart meters allow the utilities companies better insight into the usage patterns of consumers, they would also allow consumers to optimize their own usage and have the opportunity to be charged exactly for what they used, and perhaps even get discounts for using power during non-peak hours. The PMU's would allow utilities companies to identify outages sooner and react faster – allowing for a more reliable consumer experience, and more automated processes on the backend. The future was looking bright for faster, leaner, more efficient utilities companies that could engage with and understand their consumers much better.

All of this data meant amazing potential. The question was, however, how could BergmannKohler deal with this extensively vast amount of data? Bernhard had recently read an American report which stated that electric utilities already possessed 194 petabytes of data by 2009 – and this was even before the popularization of smart grid technology. Running queries on this huge amount of data would take forever, if it was even possible at all. On top of this, if the utilities companies wanted an even clearer understanding of their consumers, accessing external and potentially unstructured data from government sources and social media was an option as well. All of this was adding up to an overwhelming mountain of big data, and for a global corporation such as BergmannKohler, getting organized across eleven regions and having data centralized and accessible seemed like an unachievable prospect.

*Current IT Set-Up*

Seeing as BergmannKohler was a German company, they were an SAP house. They were equipped with SAP Business Suite and had a license for SAP HANA, although HANA had not been implemented yet and they were still unsure of the best way to deploy both HANA across the organization. The also had a license for Predictive Analytics but were not sure how to put it into play. What areas would benefit the most from Predictive? What data variable would need to be gathered? They also had a few utilities-specific solutions from SAP, including Energy Portfolio Management, Metering Service Parts Planning and Logistics and Asset Operations and Maintenance. As of now, each of the eleven regions were somewhat siloed. The each had their own set of servers, where all the data from their local power generation, distribution, and marketing initiative was kept.

In terms of smart grid assets, BergmannKohler conducted a pilot project dedicated to testing out smart meters and smart grid technology within one small city in Germany. The KPIs for whether this project would be a success were cost savings directly relating to optimized usage patterns (by optimizing load distribution, the resulting efficiencies could mean less outsourced power and more money saved), time saved in power outages due to faster response, and public acceptance of the project. On this last point they failed tremendously. A national outcry over privacy rights ensued. The Smart Meter plan has been postponed as the matter makes its way through the German legal system.  At this point, it was unclear how they would actually get the data to measure their success, and that was something they needed help with.

They knew that analytics relating to smart grids would likely be essential, and predictive tools that could, for example, allow for prevention of power outages would become the way of the future. They also wondered if there were ways to use analytics to understand their end consumer better in order to optimize according to their usage patterns.

Overall, the main questions that they wanted answered, in terms of IT set-up were:

1. How do we best deploy Big Data across the entire organization?
2. How do we best apply analytics across the entire organization? Which analytics solutions would suit us best?
3. How can we best move forward with smart grid technology? How do we measure its success?
4. How do we manage the vast amounts of data (Big Data) that will be generated through smart grid technology?
5. What are the other business areas and new business models that could be addressed by Big Data?

Bernhard knew that the company was undergoing a vast transformation as they moved in to the future, and that any changes or additions would need to be gradual and well thought-out. The implementation plan would need to be top notch.

**Strategic Directions**

Bernhard, along with the cabinet ministers and German Chancellor, were desperate for BergmannKohler to make strategic decisions that would bring the company into the future of networked energy. The Chancellor was particularly keen on making renewables and clean energy a priority, while phasing out energies that posed a greater risk to society, such as nuclear and perhaps coal. This was what the people of Germany wanted, and the Chancellor believed that they could set an example for the rest of the world. In Germany, BergmannKohler actually had the potential to influence voter sentiment to some degree. If the public liked the way that they were operating, they would support any political candidate that was onboard with them. Alternatively, if the public looked down on what BergmannKohler was doing, then any supporting politics would be figuratively shot down. Thus, the company had the ability to affect the placement of governments.

In order to put more dependence on renewables, however, the plants and distribution networks would need to be ultra-efficient, since there was not currently an abundance of renewably sourced energy available. This meant one thing to Bernhard – smart grids. But there were a lot of unanswered questions about the large scale deployment of such a technology and how to manage the big data associated with it.

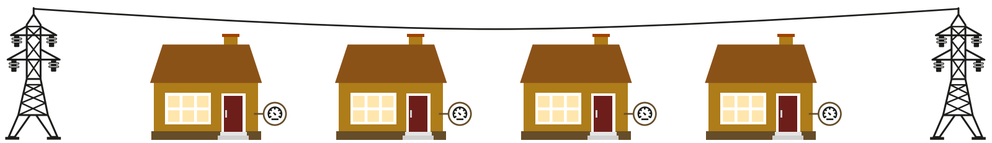
Bernhard was certain that BergmannKohler would continue to work on a broad spectrum of the value chain, from generation to distribution and marketing. This meant that they needed to manage their large assets better, and also understand their end consumer better – and they wanted to do this on a global scale. They were interested in potentially expanding operations into South America in the future, potentially Brazil, and were toying with how and when to make that move – if at all.

As Bernhard and the others finished their dessert, the Chancellor raised her wine glass. “Here is to the future of a cleaner, more innovative, and smarter Germany – and here is to Bernhard and Bergmann Kohler…we are expecting you to lead the way.” Bernhard smiled and clinked his glass. It would be an interesting road ahead.

| € in millions | 2012 | 2011 | +/- % |
|---|---|---|---|
| Electricity sales[1] (billion kWh) | 740.4 | 733.7 | +1 |
| Gas sales[1] (billion kWh) | 1,162.1 | 1,107.5 | +5 |
| Sales | 132,093 | 112,954 | +17 |
| EBITDA[2] | 10,786 | 9,293 | +16 |
| EBIT[2] | 7,027 | 5,438 | +29 |
| Net income/Net loss | 2,641 | -1,861 | – |
| Net income/Net loss attributable to shareholders of E.ON SE | 2,217 | -2,219 | – |
| Underlying net income[2] | 4,187 | 2,501 | +67 |
| Investments | 6,997 | 6,524 | +7 |
| Cash provided by operating activities of continuing operations | 8,808 | 6,610 | +33 |
| Economic net debt (at year-end) | -35,879 | -36,385 | +506[3] |
| Debt factor[4] | 3.3 | 3.9 | -0.6[3] |
| Equity | 38,819 | 39,613 | -2 |
| Total assets | 140,426 | 152,872 | -8 |
| ROACE (%) | 11.1 | 8.4 | +2.7[5] |
| Pretax cost of capital (%) | 7.7 | 8.3 | -0.6[5] |
| After-tax cost of capital (%) | 5.6 | 6.1 | -0.5[5] |
| Value added | 2,156 | 90 | – |
| Employees (at year-end) | 72,083 | 78,889 | -9 |
| Earnings per share[6, 7] (€) | 1.16 | -1.16 | – |
| Equity per share[6, 7] (€) | 18.34 | 18.76 | -2 |
| Dividend per share[8] (€) | 1.10 | 1.00 | +10 |
| Dividend payout | 2,097 | 1,905 | +10 |
| Market capitalization[7] (€ in billions) | 26.9 | 31.8 | -15 |

[1]Includes trading sales volume.
[2]Adjusted for extraordinary effects (see Glossary).
[3]Change in absolute terms.
[4]Ratio of economic net debt and EBITDA.
[5]Change in percentage points.
[6]Attributable to shareholders of E.ON SE.
[7]Based on shares outstanding.
[8]For the respective financial year; the 2012 figure is management's proposed dividend.

## Germany Consumers
Houses equipped with Smart Meter



MDUS

Smart Grid Technology

Data Streaming Server

## Regional Units
(Retail/Marketing, HR and Distribution)

| Germany | UK | Italy | France |
|---|---|---|---|
| Regional IT Setup | Regional IT Setup | Regional IT Setup | Regional IT Setup |
| SAP Systems: ERP & BW | SAP Systems: ERP & BW | SAP Systems: ERP & BW | SAP Systems: ERP & BW |
| 3rd Party Systems: (Local Power Generation, Distribution, Marketing, etc.) | 3rd Party Systems: (Local Power Generation, Distribution, Marketing, etc.) | 3rd Party Systems: (Local Power Generation, Distribution, Marketing, etc.) | 3rd Party Systems: (Local Power Generation, Distribution, Marketing, etc.) |

| Spain | Benelux | Russia | Sweden |
|---|---|---|---|
| Regional IT Setup | Regional IT Setup | Regional IT Setup | Regional IT Setup |
| SAP Systems: ERP & BW | SAP Systems: ERP & BW` | SAP Systems: ERP & BW | SAP Systems: ERP & BW |
| 3rd Party Systems: (Local Power Generation, Distribution, Marketing, etc.) | 3rd Party Systems: (Local Power Generation, Distribution, Marketing, etc.) | 3rd Party Systems: (Local Power Generation, Distribution, Marketing, etc.) | 3rd Party Systems: (Local Power Generation, Distribution, Marketing, etc.) |

| Turkey | USA West | USA East |
|---|---|---|
| Regional IT Setup | Regional IT Setup | Regional IT Setup |
| SAP Systems: ERP & BW | Non - SAP Systems: ERP | Non - SAP Systems: ERP |
| 3rd Party Systems: (Local Power Generation, Distribution, Marketing, etc.) | 3rd Party Systems: (Local Power Generation, Distribution, Marketing, etc.) | 3rd Party Systems: (Local Power Generation, Distribution, Marketing, etc.) |

## Data Warehouse

### Data Warehouse Analytics

SAP BW 7.0

## Utility Analytics

- Spreadsheets
- Reports
- Predictive Analysis

## Global Units

| Generation Portfolio Management | Renewables | New Build Projects & Innovations | IT for Worldwide Organization | Procurement for Worldwide Operations |
|---|---|---|---|---|

## Global Systems

SAP Systems
- Energy Portfolio Management
- Asset Operations & Maintenance

3rd Party Systems
- Procurement System
  Coal and LNG, Plant Supplies, Outsourced Energy

# BergmannKohler System Users

| | | | Global System | | | | Regional System | | | | Data Streaming | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | % | **Total Employees** | % | **Regular Users** | % | **Super Users** | % | **Regular Users** | % | **Super Users** | % | **Regular Users** | % | **Super Users** |
| **Global Units** | | | | | | | | | | | | | | |
| Mergers and Acquisitions | 1.00% | 720 | 10% | 72 | 10.00% | 72 | 5% | 36 | 0 | 0 | 0% | 0 | 0% | 0 |
| Trading | 5.00% | 3600 | 15% | 540 | 2.00% | 72 | 10% | 360 | 0% | 0 | 0% | 0 | 0% | 0 |
| Plant Mangement | 3.00% | 2160 | 75% | 1620 | 25.00% | 540 | 25% | 540 | 1% | 22 | 35% | 756 | 1% | 22 |
| Research | 5.00% | 3600 | 20% | 720 | 5.00% | 180 | 2% | 72 | 0% | 0 | 15% | 540 | 1% | 36 |
| Exploration | 2.50% | 1800 | 15% | 270 | 15.00% | 270 | 2% | 36 | 0% | 0 | 1% | 18 | 0% | 0 |
| Marketing | 7.00% | 5040 | 5% | 252 | 1.00% | 50 | 25% | 1260 | 5% | 252 | 5% | 252 | 0% | 0 |
| New Build Projects | 0.25% | 180 | 3% | 5 | 1.00% | 2 | 5% | 9 | 3% | 5 | 0% | 0 | 0% | 0 |
| Plant Mangement | 0.25% | 180 | 3% | 5 | 0.50% | 1 | 5% | 9 | 7% | 13 | 53% | 95 | 0% | 0 |
| **Regions** | | | | | | 0 | | | | | | | | |
| Marketing | 13.00% | 9360 | 2% | 187 | 0.00% | 0 | 43% | 4025 | 0.5% | 47 | 1% | 94 | 0% | 0 |
| Retail | 22.00% | 15840 | 2% | 317 | 0.00% | 0 | 53% | 8395 | 0.5% | 79 | 2% | 317 | 0% | 0 |
| Distribution | 9.00% | 6480 | 2% | 130 | 0.00% | 0 | 10% | 648 | 0.5% | 32 | 10% | 648 | 0% | 0 |
| **Enterprise-Wide Operations** | | | | | | 0 | | | | | | | | |
| IT | 18.00% | 12960 | 5% | 648 | 0.00% | 0 | 10% | 1296 | 0.5% | 65 | 3% | 389 | 1% | 130 |
| Procurement | 14.00% | 10080 | 5% | 504 | 0.00% | 0 | 10% | 1008 | 0.5% | 50 | 13% | 1310 | 1% | 101 |
| Grand Total | 100.0% | **72000** | 7% | **5270** | 2% | **1187** | 25% | **17694** | 1% | **565** | 6% | **4419** | 0% | **289** |