**The unexpectedness of the inevitable:**

**The implosion of a carbon bubble in the gas turbine business**

In the period of a few weeks around November 2017 the three main participants in the global gas turbine market finally acknowledged the severity of the downturn in their industry.

* They announced a cut of 18,000 jobs and factory closures around the world.
* They all sharply reduced the forecasts for future orders, sales and profits.
* And shifted their focus from selling new turbines to servicing the existing stock.
* The market leader, GE, saw a 30% reduction in its share price compared to the S&P 500 in the period between the announcement of problems in gas turbine division on 20th October 2017 and the end of the year, a $70bn movement.[[1]](#footnote-1) The sharp decline in gas turbine sales had not been predicted by the stock market.



A Siemens H class turbine.

A few months previously the companies had reported good results to their shareholders. For example, GE had reported a 12% rise in the equipment sales in the division handling gas turbines sales in its 2nd quarter 2017 results statement in July 2017. Mitsubishi Heavy Industries had publicly stuck with its forecasts for revenue and profit increases even as the market decline became obvious.

The November events were the first-ever implosion of a ‘carbon bubble’. A senior executive at Siemens is reported to have said on 16th November that ‘*the market is burning to the ground*’.[[2]](#footnote-2) Renewable energies had made substantial and unexpected share gains against a fossil fuel, undermining sales of turbines and servicing revenues.

The gas turbine suppliers are amongst the most sophisticated industrial businesses in the world. Why did they wake up so late? I provide some hypotheses. What wider lessons can managers and investors learn from the speed of the market decline and the initial reluctance of the companies to recognise the depth of the problem they faced?

The decline in gas turbine sales may or may not be permanent. The purpose of this report is not to assert that sales will never return but rather to suggest that the transition to clean energy is likely to produce rapid and unexpected value destruction in existing businesses.

**The structure of this document.**

1. First I provide some summary information about large gas turbines and the companies that make them.
2. I go on to take a summary look at the sharp reduction in the market for these turbines, as well as the business of servicing and maintaining them, in recent months and years.
3. Then I look in detail at the published statements and financial results of the main competitors over the last few financial periods. I focus on the months around each company’s final acknowledgement that the market for turbines was in severe structural decline and it needed to take significant action. For each company I examine some of the reasons why it delayed admitting that its large turbine business was in trouble. In each case the format of my commentary is slightly different because the companies report their results in varying ways.
4. GE
5. Siemens
6. Mitsubishi Heavy Industries (MHI)
7. Finally I briefly sum up what I think are the main lessons to come out of the decline in the gas turbine business for other industries and for investors.

**Section 1**

**The gas turbine manufacturing industry and its participants.**

Three companies dominate the world market for large gas turbines used to generate electricity from natural gas. These sophisticated machines cost hundreds of millions of dollars. GE (USA), Siemens (Germany) and Mitsubishi Heavy Industries (Japan) control between 80 and 90% of the global business. (REFER TO MHI source). All have operations across the world and compete vigorously for orders in their home markets and abroad. Their large turbines are installed alongside other equipment in power stations. Smaller versions are installed in industrial applications and for short-term flexible power generation.

These companies are all highly diversified and successful industrial companies, making wide ranges of products ranging from aircraft and medical equipment to ships and wind turbines. In each case, the manufacturing of large gas turbines sits within a separate division of the company that also makes other equipment for power stations, including for coal and nuclear plants, and much smaller gas turbines for industrial applications and for generating electricity for short periods.

In addition, all generate large revenues from providing maintenance and repair to gas power stations and selling equipment that improves the performance of existing plants. The making of large gas turbines (over about 100 megawatts) is probably less than half of the division’s activities in all three companies in recent years (though data is scarce on this).

**Table 1**

|  |  |  |  |
| --- | --- | --- | --- |
| **Company** | **Name of the division selling gas turbines** | **Approximate divisional revenues in 2017** | **Division’s approximate share of overall company revenues** |
| GE\* | Power | $27bn | 21% |
| Siemens | Power and Gas | €15bn/$18bn | 18% |
| Mitsubishi | Power Systems | 1,550 bn Yen/$11.5bn | 35% |

Source: approximate values from company financial statements

\*GE recently transferred a new activity into the Power division. ‘Energy Connections’ is not included in this table. Industrial solutions is also excluded because it is about to be sold.

All three companies have made recent acquisitions of smaller companies in the field. As the industry contracted slowly, they each bought smaller competitors in the turbine markets and consolidated the worldwide industry over the last few years. As I discuss later, I see these acquisitions as having a substantial role in explaining why the turbine majors took a long time to spot the global trend towards lower volumes of large turbine sales.

**BOX 1  
  
A note on a) financial years and b) terms used and c) exchange rates**

**a) Financial years**. GE’s financial years are calendar years. Unfortunately, Siemens runs its financial years from October to September and MHI from April to March. Even more confusingly, MHI’s year from April 2017 to March 2018 is termed financial 2017, the date in which the financial year starts.

I have reported all comments and financial results for the companies using their own definitions. So, for example, the quarter ending 31st December 2017 is Q4 2017 for GE, Q1 2018 for Siemens and Q3 2017 for MHI. I looked at standardising all the results using GE’s timings but I believe that this would ultimately have made my analysis less clear. Throughout this document, readers may find it helpful to anchor themselves with the knowledge that all three companies first spoke publicly about the severe problems in their gas turbine business around November 2017.

**b) Terms used**. There are three key financial measures in this paper. They are

*\* Orders*

*\* Revenue*

*\* Operating profits*

\* The three companies all use the word ‘*Orders*’ to describe a commitment by a customer to buy a turbine. Siemens makes clear that its ‘Orders’ are only recognised when they are contractual commitments. Other companies may or may not use the same definition. For example, market participants may use the term ‘order’ to describe a formal statement of intent, rather than a signature on a contract. Not all orders turn into delivered sales at some point in the future because customers sometimes cancel or amend their commitment (perhaps incurring a penalty for doing so).

*\*‘Revenue’* (Siemen’s word) seems to be recognised when the turbine is successfully shipped to the site at which it will operate. (**TO DO: check with IR at each company**). This will be usually more than a year, and possibly much longer, after the order was received. In the text of this document I sometimes use the word ‘Sales’ as interchangeable with the word ‘Revenue (also GE’s term) or ‘Net sales’ (MHI). I also occasionally use the word ‘turnover’ as a synonym.

\*‘*Operating profit’* is defined as the revenue of a division of the three companies, less the direct costs incurred to create that revenue. I usually use this term. GE uses the expression ‘Operating profit’, Siemens uses ‘Profit’ and MHI ‘Operating Income’. Operating margin is a percentage calculated by dividing ‘Operating profit’ by ‘Revenue’.

**c) Exchange rates**. I have used the rates on 11th January 2018 for all conversions, rounded to the nearest digit. The rates employed are €1=$1.20=134 Japanese Yen.

**Section 2**

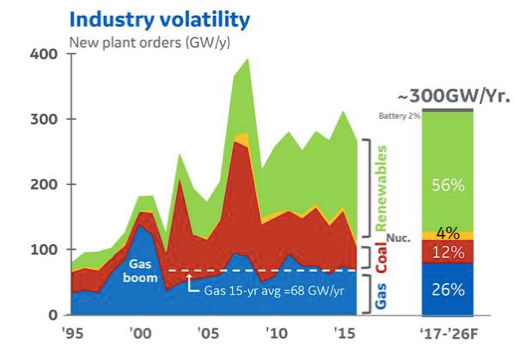
**The reduction in the world market for new gas turbines.**

We hear increasing talk of ‘carbon bubbles’, or the possibility of industries contracting sharply as the world switches away from fossil fuels. The term is most frequently used about oil and gas companies, which appear to be among the most vulnerable businesses. But the gas turbine business has suffered first.

**Gigawatts installed.**

In the boom times for new gas-fired power stations around the year 2000, the world installed over 120 gigawatts (GW) of gas turbines annually, according to GE. Additions to world power generation capacity were dominated by gas. In the fifteen years between 2011 and 2016, the average was lower, at around 68 GW but the number was relatively stable. In March 2017, GE forecast annual average sales of about 73 GW for 2017-2026. But eight months later it cut its forecast for 2017 to just 40 GW, over 40% less than the average of the last fifteen years and the lowest figure for two decades.

Chart 1



GE chart

**Number of large turbines sold and their price**

Siemens said in November 2017 that the number of large gas turbines (defined as over 100 megawatts, or MW, in power output) delivered by all suppliers in 2011 was 249. It said that the number fell slowly to 181 in 2016 but then declined sharply to 122 turbines in 2017, a reduction of almost one third in a single year. It projects unit sales of 110 turbines by all competitors worldwide in the financial 2018 to end September 2018.

The company also notes that prices obtained for large gas turbines addressing the US 60Hz market fell 30% between 2014 and 2017 as excess capacity drove producers to bid lower and lower prices. Multiplication of lower prices by smaller volumes suggest that the market size of the large gas turbine business fell by almost 60% in the three years to the end of financial 2017. But it was only in November 2017 that the companies made the scale of the market contraction explicit.

Chart 2

Siemens chart Q4 2017 analyst call.

**Ancillary sales and servicing revenues**.

Alongside the fall in large gas turbine sales, the companies’ divisions reported falling sales of smaller turbines, of ancillary equipment, such as enhancements to older turbines, and reductions in maintenance revenue as existing gas turbines worked fewer hours in the year. Perhaps the most striking single figure came from GE; its sales of what it calls its ‘Advanced Gas Path’ improvements for already operating turbine were just 33% of budgeted levels in the 3rd quarter of 2017. Forecasts of GE’s 2017 sales of smaller gas turbines, usually called ‘aero-derivative’ since they are essentially the same as aircraft jet engines, went from 96 to ‘50-55’ between the second and third quarters of 2017 financial year.

Also unpredicted have been the declines in servicing revenues, a vital source of income for all three companies. All of the businesses failed to predict that as renewables grow existing gas plants work fewer hours each day, their needs for maintenance or emergency repair would fall markedly. Nor did they appear to realise that the owners of gas-fired generating plants would become more reluctant to spend large sums upgrading their plants as the future of gas generation became murkier.

**The financial implications**

All the three participants have revealed major reductions in orders, revenue and operating profits in recent months. Forecasts made a few months ago have been cut, sometimes dramatically. MHI, for example, said it would achieve orders of 1,950 million yen in financial 2017 (the year to end-March 2018) but half way through the year cut its forecasts for the 12 month period by 25%. Probably of most importance, the number of commitments for large turbines had fallen by 50% compared to the equivalent period in 2016. Siemens’s operating profit fell by 40% from Q4 2016 to Q4 2017. Its operating margin is down to just over 40% of what it was in the middle of 2014.

**Shifting to maintaining and servicing, not selling new turbines**

In his 2018 New Year message to employees, the head of the turbine division of MHI wrote ‘*all around the world we are witnessing a rapid shift away from fossil fuels and towards renewable energies’*.[[3]](#footnote-3) He foresaw a continuation of a challenging market ‘*characterized by limited demand for new power plants’*. He went on to say that his business would now shift to concentrate on maintaining and upgrading existing power plants.

**The speed of the change: the calendar**

I hope the later text of this document will show how abruptly views about the evolution of the gas turbine market changed. Predictions were very different just a few months before the changes in forecasts.

The changes in outlook were highly concentrated around November 2017; all three major participants made important announcements within a few weeks. Perhaps once one company had published its concerns, the other two felt able to follow. When a carbon bubble implodes, we might conclude, it may affect all companies almost simultaneously. There aren’t winners and losers. All go down.

**Section 3**

**The reactions of the individual companies**

**a) GE**

20th October: GE produced its 3rd quarter results. The financial numbers were described as ‘*completely unacceptable*’ by the new CEO, largely as a result of the Power division’s failures to achieve forecasts. [[4]](#footnote-4)

13th November: Forecasts of sales of large turbines in 2018 were cut 35% below the already low 2017 figures to 65-75 units. Other sales estimates were also sharply reduced for 2018. (NEEDS REFERENCE).

7th December: GE announced 12,000 job losses in the Power division or about 18% of its worldwide divisional staff.[[5]](#footnote-5)

**b) Siemens**

9th November: Siemens alerted investors to the severity of the problems in its Power and Gas division in the results announcements for financial 2017.

16th November: Siemens announced 6,100 job losses in Power and Gas.

**c) MHI**

31st October: MHI announced substantial downward revisions to its Power and Gas division forecasts for financial 2017 (ending 31st March 2018). It said it would reorganise its factories and make other major changes to improve its cost position.

5th January 2108: The president of the Power Systems division wrote ‘*we continue to face a challenging market environment characterized by limited demand for new thermal power plants’*. *’Demand for new installations will center primarily on renewable energies’*.[[6]](#footnote-6)

**What had been expected to happen?**

The slide in turbine sales was not expected. Still less were servicing and maintenance revenues predicted to decline. The standard story was that gas would be a fuel that would grow alongside increasing renewables penetration. New power stations would be needed to function as effective complements to unreliable and unpredictable wind and solar power. Existing power stations would require servicing and upgrades as better technology became available.

This view colours all the main gas turbine company statements of the last five years. We shouldn’t be at all surprised by this; all the main international fuel companies, government agencies and independent analysts said that gas-fired generation would grow. No blame attaches to the gas turbine makers.

However the new gas boom hasn’t taken place. The International Energy Agency (IEA) says that 2016 saw about xxx gigawatts of wind and solar delivered around the world, up xxx from 2015. Gas installations fell sharply to xx gigawatts.

* The companies making gas turbines probably assumed that gas-fired generation would be cheaper than solar or wind accompanied by battery storage for at least a decade to come. But they probably should have taken into account the operating life of gas turbines. Power stations are expected to last for at least twenty five years, and possible more. So – quite rationally – investors and electricity utilities are thinking about the entire lifecycle of power plants. Why put money into new gas generation now when you know that it will be unable to compete with renewables, including storage, within a few years making your power station uneconomic and leaving ‘stranded assets’? It isn’t just **today’s** financial numbers that matter, but comparative costs over the decades of life of a power plant.
* Parts of the turbine market, particularly including smaller gas turbines, were assumed to benefit from the need for reliable back up of electricity supply in a world of high renewable energy capacity. But batteries are beginning to reduce the need for back-up generation. As importantly, power generation is decentralising, shifting from large power plants with huge turbines to local generators perhaps still using gas but not needing the most expensive products from GE, Siemens and MHI.
* And power users are increasingly flexible, shifting their demand to periods when electricity is cheap and in abundant supply. This new flexibility means that grid operators do not need vast resources of electricity generating capacity to stand idle for those times when renewables underperform. Payments to electricity suppliers to guarantee the capability to provide power (often called ‘capacity payments’) are therefore tending to fall, making it less financially worthwhile to improve existing power stations to increase generating capacity. This has particularly affected GE’s sales of AGP systems (see page xxx)
* Servicing and maintenance needs are driven by the number of hours a gas turbine works (much like a car will need servicing sooner if it covers a large number of miles). The rise in renewables is tending the decrease the utilisation of existing gas-fired power stations, at least in some countries, cutting into maintenance revenues for the main turbine suppliers.

**Section 3:**

**The stories of each of the main competitors**

1. **GE**

About a third of all the electricity generated today around the world comes from a GE turbine, including gas versions and also those made for wind, coal and nuclear power station.[[7]](#footnote-7) The company claims that it sells about half the gas turbines supplied worldwide.[[8]](#footnote-8)

**The 2nd quarter results call in July 2017**

GE’s performance in the gas turbine market appeared strong as late as July 2017. Jeff Bornstein, the Chief Financial Officer of GE, commented in the quarter 2 conference call with analysts. [[9]](#footnote-9)

*‘We expect to ship 100 to 105 gas turbines in the year, no change in that outlook. We believe that we have a technology advantage relative to competitors and we’re gaining share’.*

GE lauded the performance of the Power division.[[10]](#footnote-10)

*‘Power revenues were up 5% to $7 billion. Equipment revenues were up 12%, driven primarily by gas power systems up 17%’*

The company did recognise some threats to its financial performance arising from a contraction in the global market, but it saw no need to change any of its forecasts for its own sales for the rest of the year. It presented itself as largely immune to the turbulence in its industry.

‘*However, we’re planning for a down market this year. We expect the power market to see demand for about 40 gigawatts of power this year, down about 10%, consistent with what we said in March. We’re also planning for a down market in 2018.* [[11]](#footnote-11)

**The 3rd quarter results call in October 2017**

Just three months later, the tone was very different. In the results call for quarter 3, Jeff Bornstein, by now the outgoing CFO, said ‘*Most recently Power* (division) *emerged as a real challenge in terms of volume, profitability and cash flow’.* The division’s performance *‘was sharply lower than we expected’,* he went on. Concluding, he said ‘*So all in all a very disappointing quarter and outlook for 2017’.* [[12]](#footnote-12)

GE revised its forecasts for equipment sales downwards and also said that revenue from services would be sharply lower. The decline was driven by falling sales of ‘aero-derivative’ turbines and by equally unexpected cuts in Advanced Gas Path (AGP) revenues.[[13]](#footnote-13)

* The company had expected to sell 39 AGPs in the quarter but actually installed 13.
* The sales of aero-derivative turbines were half what had been forecast.
* Overall equipment orders for power generation (excluding Energy Connection sales) were down 37%.
* Services, rather than equipment, revenue was now expected to be ‘*down about 20% for the year’* compared to a forecast of a decline of 4% made in the second quarter earnings call.

The CFO concluded *‘The business has been undergoing market changes and we haven't changed fast enough with it’*.[[14]](#footnote-14)

**The November 2017 investor update**

Less than one month later, GE held another conference call.[[15]](#footnote-15) The purpose of this event was to provide detail to investors on how the new CEO and CFO would respond to the challenges facing the company, particularly in the Power segment.

Management announced further downward revisions in their forecasts for sales and profits. Profits from Power were projected to fall by 20% in 2017 compared to 2016 and a further 25% in 2018. The company planned to remove $1bn of costs from its operations, or about 5% of its divisional expenditures, in order to try to improve future profitability.

One of the slides used with the conference call said pithily that ‘*Power (division) aligning to market and business realities’*.[[16]](#footnote-16) The implication must be that the division had become disconnected from the outside world, ignoring the signals of steep decline in business activities.

**The press release on job losses.**

In early December 2017, GE announced that it would reduce staff numbers in the Power division by 12,000 employees, or about 18% of its worldwide workforce.[[17]](#footnote-17) [[18]](#footnote-18) The job losses were planned to occur across the division’s worldwide locations. Only four months before, staff would have had little reason for concern.

**The impact on company valuation**

At the beginning of 2017 the share price of the world’s largest gas turbine manufacturer, GE, was just under $32. It ended 2017 with its shares worth a little over $17, even as the US stock market rose strongly. Over $100 billion had disappeared from the stock market capitalisation of GE in less than twelve months, of which $30 billion was lost after the 3rd quarter results announcement.

Although its Oil and Gas division also had problems, and the GE Capital unit may not produce as much cash as planned partly because of problems in its insurance activities, one of the main causes of the massive value destruction was the unexpected fall in the sale of turbines and services related to existing gas power plants.

This is how the new CEO, John Flannery laid the blame for underperformance in his comments during the 3rd quarter conference call in late October.

*This was a very challenging quarter. While a majority of our businesses had solid earnings performance, this was offset by a decline in Power performance in a difficult market. Our Industrial CFOA* (a measure of cash flow) *for the quarter was down principally because of lower Power volume, resulting in lower earnings and higher inventory. We believe that the new leadership team at Power and the cost actions that we are taking will better position the Company in 2018 and beyond.[[19]](#footnote-19)*

In June 2017, analysts had been looking for GE to produce annual earnings per share of at least $2 in 2018.[[20]](#footnote-20) In a November update for shareholders, management forecasted a figure of just $1.00-$1.07, or little over half as much as had been predicted just a few months before.[[21]](#footnote-21)

The divisional turndown was particularly marked in GE’s cash flow estimates. In June 2017 it expected to generate a total of $12 billion of cash flow from its industrial operations. Three months later that figure was $7bn. Of the $5bn of deterioration, $3bn came from the weaker cash flow in the Power division.

**What happened in greater detail**

Slowdowns occurred within months of each other in many sections of the Power division’s business including aero-derived and standard gas turbines, the highly advanced H series large turbine, servicing and upgrades of hardware.

GE’s Power division has several component parts. Of the $27bn or so revenues of the whole division in recent years, about $10bn has come from the sale of new gas turbines for power generation, $2bn for steam power systems and $15bn from services, such as the supply of performance-enhancing AGPs and repair revenues.[[22]](#footnote-22) (A very recent addition to the portfolio of businesses within Power, ‘Grid Solutions’, adds a further $5bn to the divisional total. I exclude a segment being divested called Industrial Solutions).

I look at some component part of the division below and then give some detail on the overall financial performance of the division.

**Sales of large gas turbines for power generation**

The number of large turbines delivered by GE had peaked in recent years at over 130 in 2012. In the third quarter results presentation the number for 2017 was projected at 105. However the forecast for 2018 was cut to 65-75 units, a fall of around 35% in one year.

Chart 3

Source: GE quarterly earnings calls. 2018 forecast is the middle of the quoted range of 65 to 75 units.

**Latest generation large gas turbines for power generation**

GE invested billions in developing a turbine in the ‘H’ class, with initial installations in the first quarter of 2016. Its offering is highly efficient, converting over 62% of the energy in gas into electricity. However, within the falling overall total for GE’s Power division, the H turbine has also suffered recent slowdowns in sales. After growing sharply in 2016, with 9 deliveries in the final quarter of 2016, the first three quarters of 2017 saw average shipments of just 4.

Chart 4

Source: Quarterly earnings calls for 2016 and 2017

**Aero-derived gas turbines**

In the middle of 2017, smaller gas turbines (usually known as aero-derivative or just aero) were expected to see sales of 96 units for the whole financial year. These turbines are often used for electricity generation for short periods during daily peak demand. By the time of the 3rd quarter earnings call, this had declined to ’50-55’, a more than 40% reduction in three months.

Chart 5

Source: Quarter 3 2017 earnings call

**Orders of large gas turbines for power generation**

(An order for a large gas turbine will usually result in sales revenue when the turbine is delivered. This can be between one and three years later).

The annualized volume of orders, particularly for large power station gas turbines, has been declining for some years. However the fall was interrupted by growing numbers at the end of 2015 and beginning of 2016, partly as a result of the Power division starting to take substantial orders for the H turbine and because it included orders arising from its newly acquired Alstom subsidiary. However the number of large turbines ordered in early 2017 was around 70, compared to twice this number in early 2014.

Chart 6

Source: GE Quarterly reports

**Improvements in installed turbines**

Late 2017 also saw a clear collapse in the forecast for the deliveries of Advanced Gas Path units that improve the performance of older turbines. This activity, part of the service side of GE’s Power division, had seen consistent rises in sales between 2013 and 2016, almost tripling in the period. In mid-2017, GE forecast had been that the rise would continue for that year, with expectations of 160 unit sales. In the 3rd quarter earnings call, this number was reduced to 85, an almost 50% reduction in the space of three months.[[23]](#footnote-23) In the November update, the estimate for 2018 was cut even further to ‘a number closer to 40’.[[24]](#footnote-24) This is a 75% reduction in sales forecasts for 2018 compared to the mid-2017 prediction for 2017. Sales estimate changes such as this are extremely rare from large companies.

GE had expected that AGP sales would benefit from rising payments by grid operators to gas power stations, rewarding them for being ready to generate electricity as opposed to only paying for power as it is generated. (These are normally called ‘capacity payments’). GE’s forecast was wrong. In fact, in some of the main markets payments per megawatt of electricity generating ability actually fell. The company noted, for example, that auctions held by the main grid operator in the north east of the USA, PJM, saw a reduction from about $165 in 2015 per megawatt per day of available generating capacity to $77 for 2020-21.[[25]](#footnote-25) (The transcript wrongly records this as $177 although the clear meaning of the words is that a substantial reduction had occurred since 2015).[[26]](#footnote-26) As a result, there is less incentive for owners of older gas-fired power stations to use AGP to increase the number of megawatts available to enter into the capacity auction.

Chart 7

Source: Power and Renewable Energy Investor meeting, March 8th 2017, 2nd and 3rd quarter earnings calls 2017

**Repair and servicing**

Perhaps more surprisingly, GE also says its service income is suffering because gas turbines require less emergency repair. Renewables (excluding hydro) only provided about 8% of global electricity in 2016 but the growth of solar and wind particularly, meant that almost 40% of the increase in electricity generation came from non-fossil sources in that year.[[27]](#footnote-27)

In some countries, the growth in renewable generation has been increasing more rapidly, and in these places total amounts of electricity generated by gas have tended to fall, reducing the need for power stations to operate. The UK’s experience in the 3rd quarter of 2017 is one example of this. Electricity generated by gas fell by 11% compared to the previous year while wind and solar combined were up 12%.[[28]](#footnote-28)

A gas-fired power station that is working fewer hours is less likely to suffer a serious failure that requires the owner to call in GE service engineers. GE reported this as ‘*outages were down 18%*’ in the third quarter of 2017 compared to a year earlier.[[29]](#footnote-29) The decline had been just 9% in the second quarter of 2017.[[30]](#footnote-30)

**The overall impact on revenues and profits**

The acquisition of Alstom boosted revenues in 2016, disguising what would otherwise have been growth well below 10%. Sales revenue in the Power division actually fell in the third quarter of 2017. In the November shareholder update, GE forecast that revenue in the Power division would fall by 10% in 2018.[[31]](#footnote-31)

Chart 8

Source: GE Quarterly reports

Finally, operating profit. The Power division forecast for 2017 was initially about $5.7 bn, based on improved sales and higher margins compared to 2016. This was the estimate used in the March in the Investor Meeting. But in the November update the figure was revised down to just under $4bn, a cut of almost 30% on the earlier estimate for 2017. The operating profit for the Power division in the third quarter was just over half what it was a year earlier.

Chart 9

Source: GE March 2017 Power and Renewable Energy Investor Meeting and November shareholder update

To summarise: the rise of renewables and the increasing ability of grid operators to manage the issues arising from the intermittency of wind and solar pushed the gas turbine business of GE, including both new turbine and service activities, into a sharp reversal in the third quarter of 2017. The rate of decline across all its gas-related activities at the same time appears to have been an almost complete surprise to the company. It had forecast that world gas turbine shipments would fall 10% or so in 2017 (and further in 2018) but otherwise its predictions remained bullish right up until the 3rd quarter 2017 results announcements.

In addition, GE failed to see that the very rapid declines in the markets for turbines and associated services were bound to adversely affect the prices that the company could charge. (Siemens has said – please see page xxx - that prices per kilowatt for new turbines fell 30% between 2014 and 2017)

**Why did GE not forecast the decline in the market?**

I identify seven separate reasons for GE’s failure to predict the severity of the decline in its turbine business, even as the first signs were becoming visible.

**1, The acquisition of Alstom’s turbine business**.

GE offered to buy the turbine businesses of France’s Alstom in April 2014. This included some gas turbine assets as well turbines for coal, nuclear, hydro and wind. Alstom also had substantial revenues from servicing power station and supplying the ancillary equipment to complement the sale of turbines. The purchaser said at the time of the offer that the transaction ‘*enhances GE’s long-term growth opportunities in growing global power market’.[[32]](#footnote-32)* Regulatory obstacles delayed the closure of the transaction until November 2015, eighteen months after the offer was made. In order to obtain approval for the transaction, GE was obliged to offload some of Alstom’s gas turbine activities to a much smaller Italian rival, Ansaldo Energia.[[33]](#footnote-33) However GE retained the steam turbine assets and almost all of Alstom’s gas turbine servicing business.

The transaction added around $6bn sales to GE’s power division, raising the total divisional revenue to $26.8bn in 2016 before the addition of the Grid Solutions segment. The Alstom purchase was expected to add immediately to the profitability of GE. Specifically, the company estimated that earnings per share would be increased by at least 5 cents in 2016 and more thereafter.[[34]](#footnote-34) (An increase of 5 cents would add about 3% to the company’s overall earnings per share).

GE’s quarterly reports were enthusiastic about the progress of the integration of Alstom’s business into the Power activities of the new owner. On the Q1 2016 earnings conference call, GE’s CEO at the time, Jeff Immelt, delivered a view on the first complete three months under the new ownership.

*‘I also wanted to spike out our performance at Alstom, where we're expecting $0.05 EPS in 2016. We had solid performance in the first quarter, $3 billion of orders with renewed momentum. And I really like our opportunities for gas turbine balance of plan(t), HVDC, and steam turbines’.[[35]](#footnote-35)*

A quarter later, he was even more confident.[[36]](#footnote-36)

*‘So we really expect to see favorability in Alstom revenue synergies that we didn't count on when we did the deal. We see Alstom favorably so far and expect this momentum to continue.’*

The positive comments about the value of the Alstom acquisition continued throughout the year. By quarter 4 2016, the CFO Jeff Bornstein was able to say [[37]](#footnote-37)

*‘The Alstom integration performed well this year with total year orders of $10 billion, building a backlog that is up 18% and delivering over $1 billion of synergies in the year.’*

At the annual meeting with investors on December 14 2016, the CEO Jeff Immelt discussed the Alstom acquisition again, just over a year after GE had acquired the company. He said [[38]](#footnote-38)

*‘I like the Alstom deal more and more as time goes on’*

At the March 8 2017 meeting with investors to discuss the Power and Renewable Energy divisions, a Powerpoint slide said [[39]](#footnote-39)

‘*Alstom integration on track….above proforma on profit, cash, synergies’*

Later in the same presentation Steve Bolze, the head of the Power division, was even more enthusiastic about the value of Alstom to the turbines business [[40]](#footnote-40)

*‘Alstom has been a huge accelerator in our transformation’*

The optimism evaporated very suddenly. Eight months later, the new CEO John Flannery sang to a very different tune. In his November 13th 2017 shareholder update, the first time that any GE executive had indicated the scale of the problems in the Power division, he forcefully said that the acquisition of Alstom had been a major disappointment to the company. *[[41]](#footnote-41)*

*‘So, Alstom has clearly performed below our expectations clearly, I don’t need to tell you that.’*

He went on to say

*I see on one level (the) core principles of the acquisition have played out in their own way as we expected. The negatives to those have been significant* (as*) the market* (is) *clearly dramatically lower than what we underwrote in that business.*

In other words, Mr Flannery is saying that the reasons for buying Alstom were good at the time of purchase. However the rationale for the acquisition was undermined by the underlying decline in the markets in which Alstom operates. The ‘*hidden value in technology’* that Jeff Immelt had talked about in December 2016 was worth less than expected, the operational synergies had proved difficult to capture, the delay in concluding the purchase had cut into the pipeline of new orders and sales started to slip.[[42]](#footnote-42)

When the acquisition was finally concluded (late autumn 2015), Alstom would have seemed a good complement to the core businesses of the Power division. It added strength in steam turbines for coal and nuclear, had developed excellent products that could be sold alongside a GE gas turbine itself and had a deep reservoir of service contracts. Management of GE’s Power division was optimistic about the future and imagined Alstom’s business would help gain market share in equipment and in services.

Perhaps the Alstom takeover helped disguise the underlying problems with GE’s business and delayed the internal acceptance of their severity. Two obvious hypotheses present themselves.

* No company that makes a big acquisition wants to admit that the purchase might have been ill-advised. GE spent $11bn on Alstom, making it the company’s largest single takeover of an industrial company.[[43]](#footnote-43) We can all understand that management (and CEO Jeff Immelt in particular) would be reluctant to admit failure. Internally, and to the outside world, the underperformance of the new acquisition was denied for as long as possible. And because Alstom was such a large part of Power, adding about 30% to turnover, any admission that Alstom was failing to achieve targets would inevitably have meant that the whole division would be seen as struggling.
* GE’s internal accounting and reporting systems are recognized as strong. Any underperformance by the Alstom portion of the Power division should have been obvious but the extra complexity introduced by the acquisition may have impeded division management’s view of the underlying trends in the gas turbine markets. Faced with stagnant or falling sales in Power, it might have been difficult to see whether the cause lay principally outside the company (as now seems obvious) or whether the problems resulted from the difficulties integrating this huge addition to the company’s activities.
* Third, working with the new company will have simply distracted management and reduced their ability to see and understand what was happening to the Power division.

When a new chief executive takes over the reluctance to blame a recent acquisition for today’s financial problems disappears instantly. This happened in GE’s case as the long Immelt era came to its end. No longer did the company have to fiercely defend the decision to put $11bn at risk in the Alstom takeover. The newly acquired company can now be blamed for infecting the parent with severe cash flow or profitability problems.

**2, The lack of clarity caused by having an order book equivalent to several years of sales.**

Any business with a substantial backlog of orders that it fulfills over years will tend to be slow to spot trends in the demand for its products. It is protected by its continued ability to record high sales volumes even if its current orders dry up. Gas turbine orders, for example, can take three years to deliver, meaning that any weakening in the market will not be immediately reflected in recorded revenue figures. Similarly, much of GE’s Power division service revenues result from long-term contracts sold years in advance. It will take time for falling new orders result in lower quarterly revenues.

It is also inevitable that orders for large turbines costing hundreds of millions of dollars will vary greatly from quarter to quarter. Signing of turbine contracts may be delayed while government approval is sought or queries from financiers addressed. Turbine sales are ‘lumpy’ and not reliably and equally spread. We cannot assume a market is in decline merely because this quarter’s orders are unusually weak.

A management team (and investors as well) can avoid recognizing a slowdown in the market for much longer than a business servicing a consumer market in which orders are fulfilled almost instantly. In other words, the existence of a large order book can help observers deny the existence of a downward trend. An obvious illustration is the ratio of orders to deliveries of large gas turbines. At the second quarter conference call on July 20th 2017, the GE CFO said that the orders for the first half of the year were around 39 units but management still expected to deliver 100 to 105 units during the whole of 2017. It will not be until 2018 and later that the slowdown in orders in 2017 affects revenues.

3, **Succession problems in management**

Jeff Immelt, the long-serving CEO of GE, was replaced by John Flannery on August 1st 2017. Immelt had had the job for 16 years. He had made the Alstom acquisition and was responsible for focusing the company more on its industrial businesses, having spun out GE Capital towards the end of his tenure.

GE said that the process of searching for a new chief executive to replace Jeff Immelt began in 2011.[[44]](#footnote-44) By 2013, the company was planning for the transition to occur in mid-2017. The list of shortlisted candidates was never published but was widely thought to include Immelt’s CFO Jeff Bornstein and Steve Bolze, the head of the Power division.[[45]](#footnote-45)

Why is the succession process relevant to the failure to spot the decline in the Power business? Most obviously, if the head of Power was a candidate for the job of CEO of the entire company, as he was reputed to be, he was highly unlikely to want problems in his division to surface just as the decision about Immelt’s successor was to be made. The same point could be made, albeit less strongly, about the Jeff Bornstein, the CFO under Immelt. He would inevitably be tarred by unexpected emergence of serious revenue and profit falls in the Power division. Part of the CFO’s job is to take notice when the underlying strength of a business activity is rapidly deteriorating.

Some of the same argument can be made about the winner of the CEO race, John Flannery. He led the team that managed the acquisition of Alstom in 2014/15. He also would be reluctant to acknowledge the takeover had contributed to GE’s problems in its Power division prior to being appointed to the top job.

All three of the top contenders for the CEO job had a personal interest in ensuring that the order, revenue and profit declines in the Power division were not visible while the recruitment process was going on.

Once in place in August 2017, John Flannery was able to acknowledge that the division was seriously underperforming. Within a couple of months, he and John Bornstein agreed that Bornstein would leave GE. The third contender, Steve Bolze, was replaced as the head of the Power division. Blame for the problems in the Power division could be placed with them.

4, **Deep-rooted belief that gas has to be a major part of the power generation mix, whatever its relative cost position**

Part of the reluctance to accept that the turbine and turbine service market has declined, and may never return to previous levels, arises from a firm and unquenchable belief that gas will form an important part of the electricity generation mix for many decades to come. This might be a view that turns out to be correct. But in the face of ever declining costs of renewables and of battery storage, the role of gas in power generation might never rise above today’s levels.

In March 2017, the then CEO of the Power division presented a slide saying ‘*Energy Mix shifting to Gas and Renewables*’ even as a close look at the order book should have started alarms ringing. [[46]](#footnote-46) Nevertheless, in the face of the palpable declines in all aspects of turbine business, including sales of new machines and servicing of old installations, GE continues to believe that by 2020, gas will be growing once again.

The new head of the Power division made this point during the November 2017 update call.[[47]](#footnote-47) He said

*‘I completely acknowledge that there is a very challenged near-term environment. But we believe that we will continue to see growth in electrical consumption out into the future and that gas is going to play a role in that.’*

The new CEO of GE confidently used the following phrase in a slide in the November presentation ‘*Power is fixable..(in) 1-2 years.*[[48]](#footnote-48)

The assumption in all GE’s presentations of recent years is that gas will be needed as complement to intermittent renewables. Although renewables will grow faster than overall electricity demand, and thus will cut into the need for new power stations, the role of gas is secure because it will be the fuel of choice for those times when wind, solar, biomass or water aren’t available.

This almost ideological mindset means that even severe downturns in business will tend to be seen as short-term, and perhaps cyclical, interruptions to an underlying pattern of steady growth. Even as orders started to slip in 2016, management will have been tempted to believe that the decline was temporary, delaying any actions because of their deeply held view that the gas turbine business must return to full health at some point.

GE has more upbeat forecast of the longer terms prospect for turbine sales than almost all other industry commentators. In a March 2017 presentation to investors, GE Power indicated that it believed gas turbine sales would rise over the next ten years. It predicted global deliveries averaging around 78 gigawatts a year, up about 15% on the mean figure for the last fifteen years. SOURCE

As a comparison, the International Energy Agency’s (IEA) latest forecast suggests an average of 48 gigawatts of new gas capacity a year from 2017 to 2040, almost 40% below the GE figure.[[49]](#footnote-49) It’s worth noting that the IEA is almost universally regarded as being far too cautious about the rate of growth of renewable energy, meaning that many people would say that its forecasts for gas are likely to be too optimistic.

Nevertheless, GE says that ‘*gas generation remains stable in the long-term’* even as renewables grow rapidly around the world.[[50]](#footnote-50)

**5,** **Failure to recognize that wind and solar had become sources of electricity at comparable prices to gas**

Parts of GE appear to accept that renewables are now broadly cost competitive with fossil fuels. In the presentation at the March Power and Renewable Energy Investor Meeting, the conclusions from the renewables people were very different to the turbine management. One slide (number 77) in the renewables portion says ‘Cost of Renewables without subsidies near parity with fossil fuel’.[[51]](#footnote-51) A map on this page marks countries in which renewables are already cost-competitive in 2016. This includes all of Northern Europe as well as countries such as Mexico, Peru, Argentina and Brazil. Surprisingly, GE also includes the United Arab Emirates in this list.

By 2025, the map marks the US, China, India, Indonesia, Malaysia and Australasia as having renewables costs at least as low as fossil fuels. (This covers a large majority of the world’s total electricity needs by that date).

By contrast, in the earlier portion of the presentation dealing with gas turbines, the text says ‘Gas is the most economical energy source today’. The slide also admits that renewables are approaching cost parity but that the market is prepared to pay a premium for gas generated electricity because it is reliably available when needed. If storage capacity is added to wind or solar, GE says this makes the price of renewables well over twice the cost of gas. Unsurprisingly, this is a different message to that being offered by the Renewables division in the same session.

As with many people in the fossil fuel industries, GE seems to have failed to note the precipitate decline in the price of wind and solar, particularly in the growing markets of China, India and the rest of Asia. It uses figures for the ‘levelized cost of electricity’ from these sources which are several years out of date. This caused over-confidence in the underlying position of gas generation. Perhaps more importantly, GE under-estimates the difficulties of selling a gas turbine with a twenty five year life when a large majority of banks and industrial investors have seen the continuing downward slope in renewables costs.

**6, The totemic importance of the H class turbine**

GE is rightly proud of its new highly efficient H class turbine, the HA. With the improvements expected over the next few years it will deliver 65% efficiency, better than any other electricity generator using fossil fuel (although Siemens claims its latest design will achieve a similar level). The HA turbine already appears to have at least a 50% share of all new orders for large and advanced gas turbines. To GE, it represents the future of the fossil fuel power generation industry.

Press reports say that GE put in over $1bn in research and development expenditure to create its H class offering.[[52]](#footnote-52) In addition, the first ten or so turbines were deliberately priced lower than cost; GE knew that it could drive the H turbine down in cost as it manufactured more units. Nevertheless, this keen early pricing would have added to the financial commitment made by GE to its new technology.

At the March Power and Renewable Energy Investor meeting, the role of the H turbine was stressed. The Power division saw itself as ‘*Winning with the new HA …. best new product launch in last 20 years*’.[[53]](#footnote-53) But just 14 HA turbines were ordered in the first three quarters of 2017, down on 17 ordered in the same period in the previous year. For a senior manager to have publicly acknowledged that HA turbines were not being ordered in growing quantities would have seemed disloyal and unenthusiastic. Even mentioning low levels of new orders might well be interpreted by the outside world as an indication that the turbine was not working well in the twenty or so power stations using it already.

The central importance of the HA to GE’s future heavy duty gas turbine sales made it very difficult even to open a discussion of whether the overall market was deteriorating.

7**, Internal reorganisations**

GE’s Power division has changed its constituent parts several times in the last four years. Of course the most important change was the addition of the Alstom power generation business in later 2015. In addition, the division added the ‘Grid Connections’ business in the second half of 2017, which increased its reported revenue by over 25%. In the third quarter of 2017, GE removed the Water and Process Technologies unit from Power by selling it to SUEZ for over $3bn. Late in 2015, Renewables was removed from the Power division. It is now in a process of selling another segment covering industrial power generation.

Although GE publishes fair and accurate comparisons for orders, revenues and profits, adjusting for the gain or loss of divisional activities, it is almost inevitable that analysis of financial performance (both internally by division management and externally by stock analysts) will suffer. The changes have been so frequent that it is near-impossible to get a good understanding of underlying financial performance. The downturn that occurred was obscured by the shuffling of component businesses within the Power division. It has made independent analysis of the state of the division’s health very much more difficult than it needs to be, both for outsiders and for divisional and corporate management.

1. **Siemens**

After GE, Siemens of Germany is the second largest participant in the global market for gas turbines and their servicing and maintenance. It operates from factories in Germany and across the world.

As with GE and MHI, Siemens has acquired smaller competitors in recent years. At the end of the first quarter of financial 2015 it bought the small industrial turbines business of Rolls Royce, principally to fill a gap in its product line.[[54]](#footnote-54) Rolls Royce turbines are used in the oil and gas industry but also for generating electricity. These smaller turbines are used for power when fast starting is required, usually at times when electricity demand is particularly high.

Later in that financial year the company acquired Dresser-Rand, a company with a similar set of products to Rolls Royce. However Dresser-Rand was much larger than the earlier acquisition. These two transactions added over 10,000 employees to Siemens’ Power and Gas division. The acquired companies boosted sales by about €5bn, approximately 40% of the divisional revenues before the transactions.

**The underlying market – Siemens numbers from October 2017**

In fiscal 2011, according to the figures presented in the quarterly results meeting for Q4 2017, 249 large gas turbines were sold across the world. Siemens estimated that this had fallen to 122 units in 2017. The company projects sales of an average of 110 units a year from 2018 to 2020. (This number contrasts with the figure of 65-75 estimated by GE for its own sales in 2018 in its November investor meeting. It is unlikely that both can be correct because GE’s implied market share would be about 60%, a percentage higher than it has recently achieved).

If the Siemens number for 2018 is correct, the global market for gas turbines will have fallen by over 55% in seven years. Siemens comments that the decline from 2016 to 2018 alone is 40%.

Siemens also comments that the price of turbines (expressed as $ per kilowatt of capacity) fell by about 30% between 2014 and 2017. The implication of this is that the dollar value of the global gas turbine market may have fallen by about 63% in that three year period.[[55]](#footnote-55)

To make the obvious point, this is a very rapid shift indeed. The most well-known example of market collapse is the decline of film cameras from the introduction of inexpensive digital versions in 1999. The first three years of market contraction after this point saw the dollar value of film cameras fall by just over 44%, far less rapidly than the decline of gas turbines from 2014 to 2017.[[56]](#footnote-56) (The market for film cameras did then collapse more rapidly, typically falling at about 50% a year in value terms for the next five years).

**The unfolding of the problem over the last two years**

This section looks at how Siemens presented the performance of its Power and Gas division in the last eight quarters. My purpose is show how late it was before the company explicitly stated the division’s performance was suffering.

First, I write down the one sentence headline used in the presentation given by top management. These headlines are intended by Siemens to summarise the main theme of the Power and Gas division’s performance in the preceding three month period.

Chart 10

**The headline used in the quarterly reports**

|  |  |  |
| --- | --- | --- |
| **Year** | **Quarter** | **Headline in financial presentation** |
|  |  |  |
| **2016** | **Q1** | **Strong orders point to market wins** |
|  | **Q2** | **Great performance in a challenging market environment** |
|  | **Q3** | **Top line growth driven by strong execution in the marketplace** |
|  | **Q4** | **Revenue growth mostly driven by Egypt, tough environment remains** |
|  |  |  |
| **2017** | **Q1** | **Stringent execution, however market remains tough** |
|  | **Q2** | **Stringent execution in a difficult global market environment** |
|  | **Q3** | **Market contraction impacts top and bottom line** |
|  | **Q4** | **Structural market decline requires decisive adjustments** |

In the next chart, I show some oral comments by senior managers presenting the details of the quarterly results to analysts and investors.

Chart 11

**Quotations from the oral commentary on the quarterly reports**

|  |  |  |
| --- | --- | --- |
| **2016** | **Q1** | **Key focus is on relentlessly improving its (Power and Gas or PG) cost position. (Kaeser)[[57]](#footnote-57)** |
|  | **Q2** | **PG operates in a very competitive market environment. (Kaeser)** |
|  | **Q3** | **PG continues to operate in a market environment with significant overcapacity. (Kaeser)** |
|  | **Q4** | **The market, especially on large turbine environment remains challenging with sluggish demand. (Kaeser)** |
| **2017** | **Q1** | **The market environment for Power and Gas continues to be tough due to slow demand and continued overcapacity. (Kaeser)** |
|  | **Q2** | **(Continued) pressure on customer demand for fossil power generation… we expect decline in large gas turbine market in 2017. (Thomas)[[58]](#footnote-58)** |
|  | **Q3** | **PG continue(s) to operate in a very challenging market… Sharply lower order volume (Thomas)** |
|  | **Q4** | **..Declining markets for new units across the portfolio requires decisive adjustment.. Structural challenges. (Kaeser)** |

I summarise the tone of these written and oral comments as follows.

* In the first three quarters of 2016, Siemens saw the markets in which Power and Gas (PG) operated as very competitive. Margins were low, partly because of significant overcapacity, requiring the company to focus on reducing its costs. However the sales performance was strong.
* In the next two quarters (Q4 2016 and Q1 2017), Siemens more clearly accepted that demand was slow.
* Q2 and Q3 2017 saw an admission that PG order and sales volumes were declining sharply. But there was no explicit statement that these declines might be part of a long-term trend. In the conference calls after these results announcements, the CEO and others did say that they saw a swing away from large turbines in future but gave little indication that they saw any rapid deterioration, either in turbine sales or in servicing revenues.
* This finally changed in the reporting on Q4 2017 (July-September 2017). Siemens used the word ‘*structural*’ for the first time to provide some explanation or illustration for the scale of the decline. As Siemens acknowledged the depth of the division’s problems, it employed this new adjective in almost every public communication. The quarter 4 2017 results presentation was also unusual in showing estimates of the total size of the world large gas turbine market and how much it had shrunk in recent years. Siemens now wanted to explain why matters were so serious that it had to restructure the division and lose over 6,000 employees.

The Annual Report for 2017 used similar language to the Q4 results announcement. Published in December 2017, the document said

*‘Global energy trends continue to structurally reduce overall demand in markets for the Division’s offerings, resulting in declining new-unit business and corresponding price pressure due to current overcapacities’.*

The contrast with the 2016 Annual Report is very marked. In the earlier document, Siemens acknowledges difficulties in the steam turbine market. (These turbines are used in coal-fired and nuclear plants). But it also says

*‘In contrast, demand in the gas turbine market continued to grow in fiscal 2016, driven by rising demand for energy in emerging countries, demand for replacement of aged, inefficient and inflexible power plants: the shift from coal to gas, particularly in the U.S.; an energy market reform in Mexico; large projects in Egypt; diversification towards gas power plants in China and countries in Latin America and the Middle East.’*

**The announcement of job losses**

On November 16th 2017, Siemens announced it would look for 6,100 job losses across the Power and Gas division as a result of unprecedented structural changes in the market for large gas turbines. This represented about one eighth of the division’s employees.[[59]](#footnote-59) The press release announcing the redundancies said that Siemens was ‘*responding to the rapidly accelerating structural changes in the fossil power generation market’*. (Note the use of the word *‘structural’* again.

Lisa Davis, a member of the managing board of Siemens AG, was quoted in the release. [[60]](#footnote-60)

*The power generation industry is experiencing disruption of unprecedented scope and speed. With their innovative strength and rapidly expanding generation capacity, renewables are putting other forms of power generation under increasing pressure. Today's action follows a nearly three-year effort to right-size the business for this changing marketplace.*

**The call with local journalists in Germany**

In a November 16th conference call with journalists to talk about the implications for personnel, senior executives used even stronger language.[[61]](#footnote-61) The head of Siemens Human Resources, Janina Kugel talked of ‘*massive changes in the market’* and ‘*dramatic overcapacity’.* The market is shifting ‘*extremely quickly from conventional to renewable energies’*, she said.

Ms Kugel continued *‘in Europe…. the market for gas turbines hardly exists’.* In a summary surely unmatched by anybody else in the global turbine industry thus far, she was reported as saying that ‘*the market is burning to the ground’.*[[62]](#footnote-62)

The chief executive of the Power and Gas division made similar comments in the conference call. Jurgen Brandes said the ‘*dynamism*’ of the renewable market ‘*really caught us by surprise’*. He went on to say that '*Only two years ago, nobody would have thought a country like Saudi Arabia, as* *one of the biggest fossil fuel exporters, within the space of two years would choose not to build another power plant and install 10 GW of renewable power plants’.*

He concluded ‘*There are global trends coming that really indicate that this is a structural shift, a paradigm shift.’*

**Was the stock market surprised?**

Compared to GE and MHI, the Siemens share price performance has been resilient. The first public news of serious problems in the Power and Gas division was given in the quarter 4 results announcement of November 9th 2017. The details of job losses came a week or so later. Siemens shares fell by about 5% versus the main German DAX index during the first ten days after the results, but have since recovered to be only about 2% below their relative position in October. This is not insignificant – amounting to a relative loss of around €2bn – but doesn’t suggest that the stock market has substantially changed its view of the prospects for the entire company. Given that the Power and Gas division is only about 15% of the revenues of the entire corporation, and sales of new turbines are less than half of the divisional total, this is perhaps unsurprising. In addition, uncertainties over the profitability of the wind turbine business, Siemens Gamesa, may equally be responsible for the small relative decline in the share price.

Chart 12

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**The role of acquisitions in disguising the decline**

Without the Rolls Royce and Dresser-Rand acquisitions, the sales of the Power and Gas division would have fallen in 2015. The red line below records the rolling four quarter sales total adjusting for the arrival of new companies in the division. In the last quarter of 2015, sales for the previous 12 months would have been 17% below the previous year if the acquisitions had not been made. The blue line includes the sales of the purchased companies in division turnover, showing revenue rising strongly in early 2016. The two lines converge after four quarters as the acquired companies are included in the comparison.

By quarter 3 2017, year on year revenue comparisons start to show another fall. By the final quarter of financial 2017 (the 3 months ending September 2017) 12 month revenue is down 17% compared to a year earlier. This chart shows that absorbing the sales of Rolls Royce and Dresser-Rand did help temporarily increase the division’s revenue but the effect passes (as it also did with GE’s acquisition of Alstom and MHI’s merger with Hitachi’s turbine business).

Chart 13

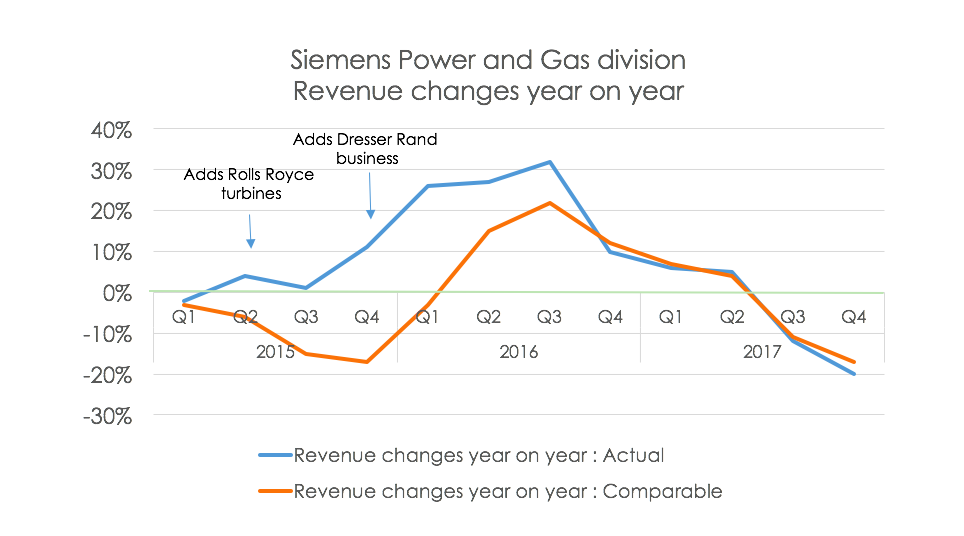
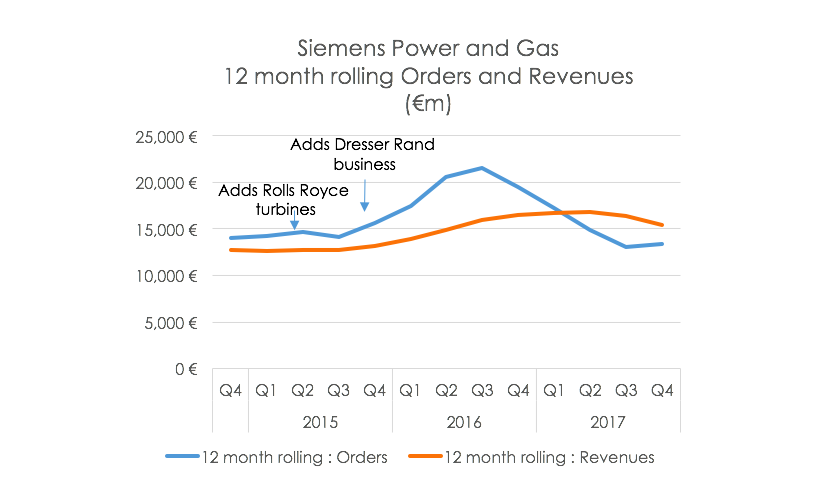
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Chart xxx looks at the numbers in a slightly different way. It compares the rolling revenue and order numbers over the past three years. Orders coming in to the division rose sharply as the acquisitions were added, peaking at well over €20bn in mid-2016. Gas turbine deliveries can be several quarters, or more, after the order is placed, so the Siemens sales revenue peaked some time later. As Siemens entered its 2017 financial year, orders dipped sharply and revenues started to fall. By the final quarter, Power and Gas was down to sales of just over €15bn a year, 7% lower than two quarters earlier. Importantly, sales are now well above order levels, meaning the backlog of unfulfilled orders is starting to slip. Orders in financial 2017 were 31% below those of the previous period.

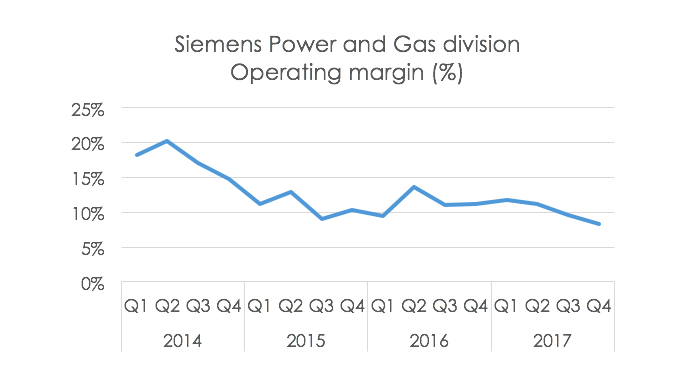
Chart 14



Source: Siemens quarterly reports

As might be expected from the decline in sales and increased downward pressure on prices, operating profits have slipped.

Chart 15



Source: Siemens quarterly reports

A comparison of the last quarter of financial 2017 (to September 2017) with the same quarter in the previous year shows profits down 40%, revenue down 17% but orders rose by 17% after adjusting for currency effects. This growth in orders is, in the company’s words ‘*driven by service (*accompanied by*) declining new-unit business’.*

**Reasons for delay in recognising the decline**

I see at least four causes for the company’s failure to spot that the problems in the gas turbine market were ‘structural’ and occurring very rapidly, rather than cyclical, temporary or slow-moving changes that it could fully manage.

1, **Acquisitions.** As with GE and MHI, acquisitions blurred the clarity with which Siemens saw the world in which it worked. The purchase of Rolls Royce, with its strong position in small turbines for fast switch-on at times of electricity shortage, and Dresser-Rand’s equivalent position in turbines for the oil and gas industry looked like excellent additions. They filled gaps in Siemens’s range of equipment and orders were boosted for four quarters or more. But the underlying market was fading fast, and inevitably these acquisitions eventually ceased to enable the division to report growing revenue.

2, **Egypt order**. Siemens won a contract to supply gas turbines totalling over 14 gigawatts in 2015. (Note for comparison that GE sees the world market for turbines as about 40 gigawatts in 2017). Siemens called the Egypt order its ‘single biggest order ever’.[[63]](#footnote-63) The massive contract – which represented over a quarter of the division’s total annual orders - was started in 2016 and is planned for completion by May 2018. The project has given a strength to sales figures which seems to have disguised the wider trends in the global market. As the completion date draws nearer, the lack of other business becomes more obvious. Huge, complex orders that demand high levels of attention from a company can mean that information on the state of the wider market does not get through to senior management.

**3, Vision 2020 and competition with GE.** For several years Siemens has been pursuing a corporate strategy that emphasises growth in the businesses of advanced digital services, automation and electrification. This strategy is often called Vision 2020. Although turbine manufacturing is not obviously a digital business, Siemens has invested heavily in R&D to improve the performance of its latest H class turbines (as has GE, in particular), using digital technologies and automation. If a business is backing a product with heavy development expenditures, the risk is that these sunk costs affect management’s willingness to contemplate a possibility that the market in which they are investing is shrinking rapidly. A manager going to his or her bosses to ask for continued cash for product development is never likely to suggest that the eventual market to be addressed is shrinking all the time.

The company has stressed that its next generation machine should be able to achieve 65% energy conversion, a number also explicitly and very publicly targeted by GE. Both companies claim that they have a clear route to achieving this number from today’s 60-62%. Improving efficiency is clearly a laudable target but the battle for product leadership between GE and Siemens may have caused a delay in asking whether the market actually needed these relatively small gains in efficiency.

**4, Sensitivity over skills losses and employment in eastern Germany.** No high technology company likes to lose employees with substantial skills. As turbine manufacture becomes more digital and more metallurgical, the Siemens redundancies will create severe losses of expertise and will probably delay any rebuilding of the division’s capabilities if and when turbine demand does start growing again.

Moreover, the wider Siemens is performing well with orders and sales in most of its divisions meeting targets. In the last financial year (2017) the group hits its overall forecast. The Power and Gas division is an outlier. Much of the employment in the company inside Germany is in the eastern part of the country (the old East Germany) where standards of living are lower than in the west and south. The plans outline for job cuts in Germany totalling 2,600. Of this about 1,200 are in the east. The company will have been reluctant to make these redundancies because of the political impact and because the rest of the Siemens group continues to generate enough profits to keep the company in a very healthy state

1. **Mitsubishi Heavy Industries**

Mitsubishi Heavy Industries (MHI) operates several divisions, covering transportation and defence as well as electricity generation through its Mitsubishi Hitachi Power Systems Division.

The Division’s market research suggests it has about 14% of the global large gas turbine market, sitting as the third placed participant behind GE and Siemens.[[64]](#footnote-64) It indicates that it has lost market share in recent years because of the technological improvements being marketed by its main competitors which it has not yet been able to match.

As with the other major competitors, it offers a wide range of turbines for power generation, including plant for coal and nuclear stations. It also carries out services, maintenance and improvement work. Servicing of existing equipment at gas power plants has tended to increase as a percentage of its sales in recent years to over half of its divisional revenues.[[65]](#footnote-65) Steam turbines for coal and nuclear plants have seen few sales.

The Power Systems division accounts for over 35% of total MHI sales and a larger share of operating income. One recent company document described it as a ‘*linchpin of the MHI Group’.* [[66]](#footnote-66)

The parent company had plans for expansion. In 2015, it suggested that sales in financial year 2017 would be 2,000 billion yen. In a revision to its forecasts in late October 2017, it said that the 2017 sales for the Power Systems division (year ends 31st March 2018) would be about 25% less than this forecast and its projections for profitability would be missed by a far greater margin. In the period between the results announcement and 5th January 2018, MHI shares fell by just under 14% against the main Japanese market index. Most of this relative decline took place in the couple of weeks after the announcement and Power Systems unexpected problems appear to have reduced the parent’s value by about 200 billion yen, or around 1.8 billion dollars.

**Information sources**

MHI’s financial years start in April. The financial year is dated by reference to the calendar year in which it began. So the fourth quarter of 2017 is January 1 to March 31st 2018

MHI publishes quarterly figures orders, sales and operating income for its Power Systems division along with some written commentary. It also offers forecasts for the entire current year for each of these three measures at all quarterly reporting points. This means that at the end of the third quarter it publishes forecasts for the full year. In the fourth quarter report it then offers figures for the following twelve months.

The company also provides frequent updates on its three year plan. Financial year 2017 is the final year of the 2015 plan. 2018 will see a new plan.

**History of recent financial and operating performance**

Looking at the figures for financial year 2016, ending in March 2017, it now seems that the decline in the gas turbine market should have been obvious to management.

Chart 16

Billion Yen

|  |  |  |  |
| --- | --- | --- | --- |
| Orders | 2015 | 2016 | Change |
|  | 2005.0 | 1688.7 | -16% |

The forecast for 2016 orders at the beginning of the financial year was 2,100 billion yen. Actual orders were therefore 20 % below the prediction twelve months earlier

Chart 17

Revenue

|  |  |  |  |
| --- | --- | --- | --- |
| Sales | 2015 | 2016 | Change |
|  | 1547.7 | 1470.4 | -6% |

The forecast for sales for 2016 was 1,700 billion yen at the beginning of the year. Sales were 14% lower than predicted at the beginning of the year.

Chart 18

Operating income

|  |  |  |  |
| --- | --- | --- | --- |
| Operating income | 2015 | 2016 | Change |
|  | 154.6 | 110.5 | -29% |

The division was set an operating income target of 190 billion yen for 2016. It missed this by -42%.

So although the forecasts for 2016 at the beginning of the year all predicted that business performance would improve, the 2016 figures ended up substantially below the 2015 numbers.

The reasons the company gave for the substantial shortfalls were not detailed. It simply said the fall in orders was due to customer delays and cancellations.[[67]](#footnote-67)

*In the Energy & Environment segment* (the previous name for the Power Systems division*), orders were generally down due to the suspension of some large-scale thermal power plant projects and the delay of related business negotiations, both in Japan and overseas.*

A similarly unspecific rationale was provided for the fall in operating income.[[68]](#footnote-68)

*In the Energy & Environment segment, operating income decreased by 44.1 billion yen year-on-year. This was largely due to the emergence of an imbalance between business scale and balance sheets and fixed costs, as sales of thermal power plants decreased at Mitsubishi Hitachi Power Systems*.

I interpret this statement as meaning that the company had intended the division to grow in 2016 and retained staff and other expenditures to service this higher level of sales. However the sales of power plants actually fell and the costs of the division were therefore too high, affecting profits.

None of the comments made by the company at the end of financial 2016 suggested any serious problems in the Power Systems area. Instead of focusing on turbines, the company spent more time commenting on the problems in its transportation division, which saw substantial losses over the year.

The most substantial explanation of why the decline in Power Systems profitability occurred is provided on page 17 of the results announcement.[[69]](#footnote-69)

*In the 4th quarter, sales and profits from after-sale servicing operations failed to grow to the extent anticipated from the pattern of earlier years; and as a result the scale of our after-sale servicing business, which usually generates higher margins, decreased, leading to a substantial deterioration in operating income this term.*

More explanation was provided in the Question and Answer section after the presentation. In response to a query about the decline in servicing revenue, the company said: [[70]](#footnote-70)

*Operating rates have been declining at plants installed in Asia and Europe which were seen as a target for maintenance. As a result, the volume of after-sales services has also declined, which is a major factor in explaining why the target was missed in Q4. We do not expect any major changes in the business environment, but the operating rates of customers’ plants and demand for after-sales services will both improve in line with the global economic recovery.*

There are also unspecific references to factories that insufficiently busy and remaining inefficiencies not driven out after the 2012 takeover of the Hitachi power generation business.

**The forecasts for 2017.**

MHI issued predictions for the orders, revenue and operating income for the Power Systems division.

Chart 19

Billion Yen

|  |  |  |  |
| --- | --- | --- | --- |
| Orders | 2016 | Forecast 2017 | Change |
|  | 1688.7 | 1950 | +15% |

The shortfall in orders in 2016, which fell 16% below the 2015 figure, were projected to be reversed. 1,950 billion Yen would restore the order levels almost to the 2015 level.

Chart 20

|  |  |  |  |
| --- | --- | --- | --- |
| Revenue | 2016 | Forecast 2017 | Change |
|  | 1470.4 | 1650 | +12% |

Sales figures were expected to improve to beyond the 2015 achievement, rising 12% from 2016

Chart 21

Operating income

|  |  |  |  |
| --- | --- | --- | --- |
| Operating income | 2016 | Forecast 2017 | Change |
|  | 110.5 | 145 | +31% |

Across all the three main operating metrics, (orders, revenue and operating profit), the company predicted an improvement in Power Systems in 2017, taking financial results approximately to the levels achieved in 2015. The implication is that the MHI saw the sharp deterioration in the division’s performance in 2016 as a temporary blip, not a trend.

**The results of quarter 1 and quarter 2 2017 (April-September 2017)**

When MHI published the first quarter’s results for Power Systems on July 31st, covering April to June 2017, the optimism shown in the annual forecast looked overdone. Orders, sales and profit were all down on the 2016 figures.

Orders ran at just over 60% of the depressed 2016 figure in the division. Sales were down about 2%. Profits almost disappeared. In particular, MHI said that sales of big gas turbines were down.

Nevertheless, the company retained its divisional forecasts unchanged for financial 2017.[[71]](#footnote-71) This was despite writing in a May planning document that [[72]](#footnote-72)

*‘orders are in a severe situation, with service-related construction work in decline’*

and

‘*sluggish ongoing demand for new GTCC* (gas turbine combined cycle) *worldwide’*

In the same May document it also suggested that the worldwide market for large gas turbines would be down over 10% in financial 2017 to 57 gigawatts of new capacity (or perhaps about 120-140 turbines).

In response to questions after the results were announced it also said [[73]](#footnote-73)

*We still hope to attract orders in line with our target set at the start of the fiscal year. However, in light of intensifying competition and other factors, we cannot be entirely certain of reaching our original projection.*

Quarter 2 results were published on October 31st 2017. They showed total orders for Power Systems for the first half of the year down 2% on 2016. (In other words the position had improved in relative terms since the first quarter which had shown sharply lower orders than the equivalent quarter in the previous year). But sales were down by 6%, an increased decline since the first quarter’s results and operating profit was also much below the depressed 2016 levels.

This finally prompted a full revision of published expectations for the financial year.

Chart 22

Power Systems forecasts for financial 2017 (billion yen)

|  |  |  |  |
| --- | --- | --- | --- |
|  | End of Quarter 1 2017 | End of Quarter 2 2017 | Percentage change |
| Orders | 1950 | 1450 | -26% |
| Sales | 1650 | 1550 | -6% |
| Operating profit | 145 | 100 | -31% |

Source: MHI quarterly reports

The company’s results announcement noted the particular deficiencies in new large gas turbines, saying that this portion of Power Systems activities had adversely affected orders, sales and operating profit. In addition, in questions and answers after the results presentation, MHI said that lower number of operating hours for the gas turbines that it services has reduced maintenance requirements.[[74]](#footnote-74) This is similar to comments from GE.

It also noted that it had only shipped 4 large gas turbines in the half-year. This compares to 8 in the equivalent period in the preceding year.

*We lowered our orders outlook because the booking of some large orders has been pushed back, and because the environment surrounding the thermal power plant business has become severe. Further, a decline in operational rates of gas turbines is eroding sales volume from after-sale servicing operations, and we expect this situation to continue for two to three years.*

This response suggests that even in late October 2017 the decline in Power Systems financial performance was seen as temporary. Orders had been ‘*pushed back’*, rather than cancelled. The fall in after-sales revenues will ‘*continue for two to three years*’ not permanently.

But by the beginning of 2018, a more pessimistic attitude had taken shape. In his New Year message to employees, the President of the Power Systems division wrote that [[75]](#footnote-75)

*‘all around the world we are witnessing a rapid shift away from fossil fuels and towards renewable energies..... we continue to face a challenging market environment characterized by limited demand for new thermal power plants.’*

This seems equivalent to the Siemens change in opinion in late 2016 that the fall in gas turbine sales was now ‘structural’ rather than cyclical. The Division President went to state that the new 3 year business plan would focus not on selling new large gas turbines but on the servicing and improvement of existing gas-fired power stations. This is in sharp contrast to the New Year’s message of 2017, which had focused on the need to improve the turbines on sale.[[76]](#footnote-76) ‘*Continuous, sustained* ***product*** *development will be the Company’s lifeline’* Kenji Ando wrote then. (Emphasis not in text). Slowly, painfully, the Power Systems division is acknowledging that its core market of the last decade – large and highly efficient gas turbines – has dried up.

**Part 2**

**Why did it take MHI so long to accept the decline in gas turbines?**

None of top three manufacturers, including MHI, seemed to have accepted before late 2017 that the fall in sales was likely to be permanent, or at least long-term. Why was MHI slow to react? I have six suggested reasons for the division’s sluggish response. Some of these are similar to forces at work also in GE and Siemens over the last two years.

1, **The 2015-2017 three business plan for the MHI power business.** In late 2014, the company produced a three year business plan that targeted the sales of MHI rising to 5,000 billion yen by 2017.[[77]](#footnote-77)Of this, 2,000 billion yen were projected to come from Power Systems (then called Energy and Environment). Orders were forecast at 2,300 billion yen and operating income at 240 billion yen. Although the quarterly forecasts since the plan was published have changed the annual projections several times, alterations to the forecasts have lagged the slowdown in the market. In its quarter 2 2017 forecasts, the Power Division moved its forecast down to an order volume of 1,450 billion yen, 37% below the 2015-17 business plan figure. Sales forecasts for 2017 are now over 20% below target and operating profit is projected at 55% lower than the business plan.

One hypothesis is that the existence of the business plan caused management to delay the point at which it recognised the seriousness of the fall in the gas turbine market. Every few months since the publication the company has provided an analysis of how it is performing against the medium-term plan. It is understandably reluctant to show clearly that performance is diverging from substantially from the medium-term plan and the financial targets will not be achieved for the final year of 2017. Until the financial undershoots have become utterly obvious, forecasts are not pulled into line with reality.

2, T**he merger with Hitachi in 2014**. (Repeated emphasis on PMI). As with GE, and Siemens to a lesser extent, the creation of the Power Systems through a joint venture with Hitachi in early 2014, has diminished the ability of management and outside analysts to see exactly how the division is performing. When GE bought most of Alstom’s power activities, it saw a major rise in sales as the purchase brought in new customers from the acquired company. Short-term operating improvements seem to disguise the underlying weakness in the markets in which the enlarged company operates.

In GE’s case the boost lasted a year or so and for MHI the effect seems to have lasted a little longer. But as the falling market overwhelms the sales growth arising from the business combination, concerns have appeared in both cases. In GE’s case, fully acknowledging the problems took until November 2017 but MHI’s apparent concern over the integration of the two businesses surfaced sooner. In the May 2017 Business Plan update, for example, management mentions the need to ‘accelerate PMI’ and pursue cost reductions.[[78]](#footnote-78) (‘PMI’ refers to ‘post merger integration’, a way of describing cost cuts that try to improve the overall efficiency of the merged entity). The 2017 annual report said that integration of the Hitachi and Mitsubishi business has been ‘slower than expected’.[[79]](#footnote-79) These nagging concerns make it more difficult to see the underlying trends in the markets in which the business operates.

3, **Falling behind on technology**. MHI Power Systems division does not yet have an effective competitor to the advanced H series turbines of GE and Siemens. In the case of GE, it blamed some of the sales softness of recent quarters on a delayed uptake of the H turbine by its customers and its relatively high price. MHI sees almost the reverse story. It says that its performance has deteriorated because it cannot match the performance of the latest turbines from its competitors. Both of these hypotheses cannot be right but they can serve as an apparent rationale for weak sales in the two companies. The truth may be that financial weakness is actually derived from the underlying lack of demand and whether or not the competitor has an H class product is not relevant.

4, **Distracted by worries about Shipping and Aviation**. During the last few years, MHI has fought fires in several different divisions other than Power Systems. It has struggled to launch a commercial airliner, had quality problems with new cruise ships and had to make design changes to its LNG carrier. In highly diversified business such as GE, Siemens and MHI top management may have too many other concerns to work out whether the weakening in a division’s performance arises from market collapse or divisional inefficiency.

5, **Lengthening time between orders in Power Systems (and elsewhere) and delivery**. MHI explicitly notes that the shipping of a product in its portfolio is now typically taking several months longer from the point of order.[[80]](#footnote-80) This conclusion applies to Power Systems division products as well as to other industrial goods and services across the company. All the three main companies making large gas turbines have large order books of turbines waiting for manufacture and delivery.

A backlog can be used – to some extent – to smooth quarterly revenues. (Sales revenue will only be recognised when the turbine is finally in place at the power station, not when the order is made). However a lengthening time between order and delivery introduces an artificial boost to the order backlog.

Say, for example, a turbine is delivered 24 months after order. Order books will thus be twice the size of annual sales. If the delivery delay rises to 36 months, the typical size of order backlog will rise. To outsiders (and indeed many insiders) this will increase in backed-up orders will look healthy. It suggests a rising demand. But in fact the underlying demand is the same and the 36 month delay actually introduces a greater risk of order cancellation.

In the case of goods produced by the Power Systems division, the backlog has been relatively constant over recent quarters. Given the lengthening of time between order and delivery, this implies a fall in future sales. This point does not appear to have been picked up by analysts covering any of the big three turbine manufacturers.

6, **End-year weighting in MHI sales and orders**. The main gas turbine manufacturers typically all tend to have strong second halves of their financial years. But the proportion of total annual sales represented by each quarter varies, partly because of the lumpiness of turbine orders. Outside analysts and managers can only have limited ability to forecast full year sales until the last few months of the financial period. The fact that all three manufacturers did not announce substantial revisions to their orders and sales expectations until well into the second half of the year in financial 2017 is therefore not unexpected. More generally, the lack of consistency in order volumes from month to month seems to have allowed the companies to hold off making predictions about future sales.

**Conclusion: lessons to be learnt**

1, Companies and investors have underlying mental models of the industry in which they are work. In the gas turbines market, all have accepted for some years that renewables will capture growing shares of electricity generation around the world. But participants also believed, and many still appear to believe, that gas is absolutely necessary complement to renewables. New large gas-fired power stations will grow alongside renewables, they thought at least until recently. Industry participants are not adjusting their mental model fast enough. This is unsurprising; we are all stuck with outdated maps of our worlds.

2, When the inevitable downturns come, they may affect all portions of any industry at the same time. Today, as the market for new gas turbines struggles against strong headwinds, the Power divisions of the main competitors are restating their faith in the servicing and upgrade markets. But the last few years have shown that as renewables capture share, gas-fired power stations operate less. They need less maintenance and have fewer breakdowns. Servicing revenues are likely to see stagnation. Upgrades to older plants may also fall as investors resist putting large sums into improving assets that may not cover today’s operating costs.

3, Acquisitions, management changes, divisional reorganisations all tend to make the true underlying state of a business activity murky and disputable. Seeing the true underlying trends becomes near-impossible. But, nevertheless, when divisions of large companies run into trouble, the temptation facing top management to try to ameliorate operating performance by reorganisations and changes in personnel is difficult to resist.

4, Successful companies are often the best at planning the strategy for the future and investing in the development of new technologies that improve their products. The efforts by GE and Siemens, in particular, to push forward their H class turbines at considerable expense creates an unwillingness among managers to accept that these improvements may be largely unrewarded by the market. The more R&D-focused a company, the more reluctant it may be to change direction because of the costs already sunk into improving their products. A clear, analytic and well-defined corporate strategy, developed over years may make it more difficult, not less, to accept that a favourite market is no longer attractive.

5, Perhaps the central lesson of the collapse of the market for new gas turbines in 2017 is that the deflation of carbon bubbles may occur first in capital goods markets, not the business of extracting or selling energy from fossil fuels. Capital goods are bought by customers to add capacity to an industry such as electricity generation. If growth in that industry stalls, then the capital goods suppliers suffer more than the providers of raw materials. For example natural gas demand from power stations around the world has not fallen by much, if at all, even as the gas turbines shrinks. The place to look for the next carbon bubble implosion is in industries supplying very expensive and long-lived equipment to companies in the chain of fossil fuel activities from exploration to the burning of the fuel.

1. Other factors may have assisted in pushing down the GE share price in this period but much of the slippage appears to be driven by problems in the Power division. [↑](#footnote-ref-1)
2. https://uk.reuters.com/article/us-siemens-power-restructuring/siemens-to-cut-6900-jobs-to-tackle-flailing-turbines-business-idUKKBN1DG257 [↑](#footnote-ref-2)
3. http://www.mhps.com/news/20180105.html [↑](#footnote-ref-3)
4. https://seekingalpha.com/article/4115222-general-electrics-ge-ceo-john-flannery-q3-2017-results-earnings-call-transcript?part=single [↑](#footnote-ref-4)
5. https://www.bloomberg.com/news/articles/2017-12-07/ge-is-said-to-plan-12-000-job-cuts-as-new-ceo-revamps-power-unit [↑](#footnote-ref-5)
6. http://www.mhps.com/news/20180105.html [↑](#footnote-ref-6)
7. <https://www.ge.com/investor-relations/sites/default/files/GE-USQ_Transcript_2017-11-13.pdf> Page 15 [↑](#footnote-ref-7)
8. <https://www.ge.com/investor-relations/sites/default/files/GE-USQ_Transcript_2017-11-13.pdf> Also Page 15 [↑](#footnote-ref-8)
9. <https://seekingalpha.com/article/4089530-general-electrics-ge-ceo-jeff-immelt-q2-2017-results-earnings-call-transcript?part=single> [↑](#footnote-ref-9)
10. https://www.ge.com/investor-relations/sites/default/files/ge\_webcast\_presentation\_07212017.pdf [↑](#footnote-ref-10)
11. <https://seekingalpha.com/article/4089530-general-electrics-ge-ceo-jeff-immelt-q2-2017-results-earnings-call-transcript?part=single> [↑](#footnote-ref-11)
12. <https://seekingalpha.com/article/4115222-general-electrics-ge-ceo-john-flannery-q3-2017-results-earnings-call-transcript?part=single> [↑](#footnote-ref-12)
13. Aero-derivative refers to turbines that were designed first to work as jet engines for aircraft, adjusted to generate electricity instead. AGP refers to a hardware and software upgrade to existing gas turbines that allows them to work at slightly higher efficiency and go for longer intervals without major servicing. [↑](#footnote-ref-13)
14. <https://seekingalpha.com/article/4115222-general-electrics-ge-ceo-john-flannery-q3-2017-results-earnings-call-transcript?part=single> [↑](#footnote-ref-14)
15. https://seekingalpha.com/article/4124617-general-electrics-ge-ceo-john-flannery-hosts-investor-update-conference-call-transcript?part=single [↑](#footnote-ref-15)
16. https://seekingalpha.com/article/4124705-general-electric-ge-investor-presentation-slideshow?part=single [↑](#footnote-ref-16)
17. http://www.genewsroom.com/press-releases/ge-power-announces-global-headcount-reduction-12000-jobs-part-plan-take-out-1-billion [↑](#footnote-ref-17)
18. https://www.bloomberg.com/news/articles/2017-12-07/ge-is-said-to-plan-12-000-job-cuts-as-new-ceo-revamps-power-unit [↑](#footnote-ref-18)
19. https://www.ge.com/investor-relations/sites/default/files/quarterly\_data/release/ge\_webcast\_pressrelease\_10202017\_1.pdf [↑](#footnote-ref-19)
20. https://www.ft.com/content/7a2da44c-4f89-11e7-a1f2-db19572361bb [↑](#footnote-ref-20)
21. <https://seekingalpha.com/article/4124705-general-electric-ge-investor-presentation-slideshow?part=single> Page 49 [↑](#footnote-ref-21)
22. <https://www.ge.com/investor-relations/sites/default/files/GE%20Investor%20Update_Presentation_11132017.pdf> Page 37 [↑](#footnote-ref-22)
23. https://seekingalpha.com/article/4115222-general-electrics-ge-ceo-john-flannery-q3-2017-results-earnings-call-transcript?part=single [↑](#footnote-ref-23)
24. https://seekingalpha.com/article/4124617-general-electrics-ge-ceo-john-flannery-hosts-investor-update-conference-call-transcript?part=single [↑](#footnote-ref-24)
25. https://www.utilitydive.com/news/pjm-auction-results-could-push-nuke-operators-to-double-down-on-subsidies/444040/ [↑](#footnote-ref-25)
26. https://www.ge.com/investor-relations/sites/default/files/GE-USQ\_Transcript\_2017-11-13.pdf [↑](#footnote-ref-26)
27. https://www.bp.com/en/global/corporate/energy-economics/statistical-review-of-world-energy/renewable-energy.html [↑](#footnote-ref-27)
28. https://www.gov.uk/government/uploads/system/uploads/attachment\_data/file/669750/Energy\_Trends\_December\_2017.pdf [↑](#footnote-ref-28)
29. https://seekingalpha.com/article/4115222-general-electrics-ge-ceo-john-flannery-q3-2017-results-earnings-call-transcript?part=single?part=single [↑](#footnote-ref-29)
30. https://seekingalpha.com/article/4089530-general-electrics-ge-ceo-jeff-immelt-q2-2017-results-earnings-call-transcript?part=single [↑](#footnote-ref-30)
31. <https://seekingalpha.com/article/4124705-general-electric-ge-investor-presentation-slideshow?part=single> Page 50 [↑](#footnote-ref-31)
32. https://www.ge.com/sites/default/files/ge\_webcast\_pressrelease\_04302014\_0.pdf [↑](#footnote-ref-32)
33. http://www.genewsroom.com/press-releases/ge-completes-divestment-power-generation-assets-ansaldo-energia-282685 [↑](#footnote-ref-33)
34. https://www.wsj.com/articles/ge-completes-alstom-power-acquisition-1446477255 [↑](#footnote-ref-34)
35. <https://seekingalpha.com/article/3967396-general-electric-ge-jeffrey-r-immelt-q1-2016-results-earnings-call-transcript?part=single>. The acronym HVDC refers to high voltage direct current transmission lines, now usually used for long-distance transport of electricity. [↑](#footnote-ref-35)
36. https://seekingalpha.com/article/3990696-general-electric-ge-jeffrey-r-immelt-q2-2016-results-earnings-call-transcript?part=single [↑](#footnote-ref-36)
37. https://seekingalpha.com/article/4038340-general-electrics-ge-ceo-jeff-immelt-q4-2016-results-earnings-call-transcript?part=single [↑](#footnote-ref-37)
38. https://seekingalpha.com/article/4030623-general-electrics-ge-ceo-jeffrey-immelt-hosts-annual-outlook-investor-meeting-conference?part=single [↑](#footnote-ref-38)
39. <https://seekingalpha.com/article/4053094-ge-power-and-renewable-energy-investor-meeting?part=single> (slide 14) [↑](#footnote-ref-39)
40. <https://seekingalpha.com/article/4053094-ge-power-and-renewable-energy-investor-meeting?part=single> (slide 69) [↑](#footnote-ref-40)
41. https://seekingalpha.com/article/4124617-general-electrics-ge-ceo-john-flannery-hosts-investor-update-conference-call-transcript?part=single [↑](#footnote-ref-41)
42. <https://seekingalpha.com/article/4030780-ge-annual-outlook-investor-meeting-slides?part=single> (Page 9) [↑](#footnote-ref-42)
43. https://www.gepower.com/about/alstom-acquisition [↑](#footnote-ref-43)
44. https://seekingalpha.com/article/4081157-john-flannery-replaces-jeffrey-immelt-ceo?part=single [↑](#footnote-ref-44)
45. See, for example, https://chiefexecutive.net/ge-succession-plans-focus-immelt-retirement-rumors-swirl/ [↑](#footnote-ref-45)
46. <https://seekingalpha.com/article/4053094-ge-power-and-renewable-energy-investor-meeting?part=single> Page 15 [↑](#footnote-ref-46)
47. https://seekingalpha.com/article/4115222-general-electrics-ge-ceo-john-flannery-q3-2017-results-earnings-call-transcript?part=single [↑](#footnote-ref-47)
48. https://seekingalpha.com/article/4053094-ge-power-and-renewable-energy-investor-meeting?part=single [↑](#footnote-ref-48)
49. http://www.iea.org/weo2017/#section-1-3 [↑](#footnote-ref-49)
50. <https://seekingalpha.com/article/4053094-ge-power-and-renewable-energy-investor-meeting?part=single> See chart 15 [↑](#footnote-ref-50)
51. https://seekingalpha.com/article/4053094-ge-power-and-renewable-energy-investor-meeting?part=single [↑](#footnote-ref-51)
52. http://www.powermag.com/worlds-most-efficient-combined-cycle-plant-edf-bouchain/?printmode=1 [↑](#footnote-ref-52)
53. <https://seekingalpha.com/article/4053094-ge-power-and-renewable-energy-investor-meeting?part=single> Slide 14 [↑](#footnote-ref-53)
54. https://www.siemens.com/press/en/pressrelease/?press=/en/pressrelease/2014/corporate/2014-q2/axx20140536.htm [↑](#footnote-ref-54)
55. Siemens does not provide a figure for the number of gas turbines sold in 2014 but does provide figures for 2013 and 2015. Linearly interpolating between the 2013 and 2015 numbers suggests the market was about 199 units in that year. A reduction from 199 to 122 in 2017 at a price of 40% less than in 2014 suggests global sales value fell by 63.2%. This estimate assumes that the average size of turbine sold remained constant. [↑](#footnote-ref-55)
56. Figures for film camera sales are available here. http://www.cipa.jp/stats/documents/common/cr400.pdf [↑](#footnote-ref-56)
57. Joe Kaeser, CEO, Siemens [↑](#footnote-ref-57)
58. Ralf Thomas, CFO, Siemens [↑](#footnote-ref-58)
59. http://www.powermag.com/siemens-reportedly-downsizing-power-and-gas-business/ [↑](#footnote-ref-59)
60. https://www.siemens.com/press/en/events/2017/corporate/2017-11-conference-call.php [↑](#footnote-ref-60)
61. https://edge.media-server.com/m6/p/poheqety/lan/en [↑](#footnote-ref-61)
62. http://www.powerengineeringint.com/articles/2017/11/6-900-jobs-go-at-siemens-power-division-as-market-burns-to-the-ground.html [↑](#footnote-ref-62)
63. https://www.siemens.com/press/en/pressrelease/?press=/en/pressrelease/2017/power-gas/pr2017020148pgen.htm&content[]=PG&content[]=Corp [↑](#footnote-ref-63)
64. <https://www.mhi.com/finance/library/plan/pdf/h29_05keikaku.pdf>. See slide 21, bottom right [↑](#footnote-ref-64)
65. <https://www.mhi.com/finance/library/plan/pdf/h29_05keikaku.pdf> See slide 21, top right [↑](#footnote-ref-65)
66. <http://www.mhps.com/news/20170105.html> [↑](#footnote-ref-66)
67. <https://www.mhi.com/finance/library/result/pdf/h29_05/setsumei_summary.pdf> Page 7 [↑](#footnote-ref-67)
68. <https://www.mhi.com/finance/library/result/pdf/h29_05/setsumei_summary.pdf> Page 11 [↑](#footnote-ref-68)
69. <https://www.mhi.com/finance/library/result/pdf/h29_05/setsumei_summary.pdf> Page 17 [↑](#footnote-ref-69)
70. https://www.mhi.com/finance/library/result/pdf/h29\_05/qanda\_2016.pdf [↑](#footnote-ref-70)
71. However in a confusing presentation on MHI’s three year business plan for 2105-2017 on May 9 2017 the company appears to reduce its target for orders in Power Systems by 350 billion yen for 2017. <https://www.mhi.com/finance/library/plan/pdf/h29_05keikaku_summary.pdf> Page 7. Nevertheless, the order forecast is retained at 1950 billion yen in the Q1 financial results presentation of July 31st 2017. <https://www.mhi.com/finance/library/result/pdf/h29_05/setsumei_summary.pdf>

    Page 12. [↑](#footnote-ref-71)
72. <https://www.mhi.com/finance/library/result/pdf/h29_07/setsumei_summary.pdf>

    Page 20 [↑](#footnote-ref-72)
73. <https://www.mhi.com/finance/library/plan/pdf/h29_02keikaku.pdf> [↑](#footnote-ref-73)
74. https://www.mhi.com/finance/library/result/pdf/h29\_10/qanda\_20171h.pdf [↑](#footnote-ref-74)
75. http://www.mhps.com/news/20180105.html [↑](#footnote-ref-75)
76. http://www.mhps.com/news/20170105.html [↑](#footnote-ref-76)
77. https://www.mhi.com/finance/library/plan/pdf/h27\_05keikaku\_summary.pdf [↑](#footnote-ref-77)
78. https://www.mhi.com/finance/library/plan/pdf/h29\_05keikaku\_summary.pdf [↑](#footnote-ref-78)
79. https://www.mhi.com/finance/library/annual/pdf/report\_2017.pdf [↑](#footnote-ref-79)
80. <https://www.mhi.com/finance/library/plan/pdf/h29_05keikaku_summary.pdf> Slide 8 [↑](#footnote-ref-80)