MORNING BRIEFING
November 28, 2017

Electric Lights-Out Orchestra

See the collection of the individual charts linked below.

(1) Cordless devices need cords for docking stations. (2) GE and Siemens generating less interest for their large turbines. (3) GE blames renewables. (4) Power is getting decentralized in the electric power business. (5) Less demand for coal-fired plants in China and India. (6) Emerging economies emerging into services. (7) Electric cars could juice up electricity demand, met by more solar panels. (8) Cobots are more human-friendly than robots. (9) Last one to leave the factory floor gets to shut the lights off forever.

Disruptive Tech I: Decentralizing Power. More and more electric devices are cordless, but you still need a cord for their recharging docks. There certainly are more and more cordless electric-powered devices that must be recharged—phones, tablets, watches, and personal assistants, to say nothing of electric cars. It's turned the power going into the cord into a hot commodity. Our addiction to these electrified gadgets combined with a growing global economy should mean these are the glory days for companies producing turbines that turn gas and coal into electric power. However, both GE and Siemens recently reported their power turbine divisions have fallen on tough times. So this seems like an opportune time to plug into the current state of the electricity market. I asked Jackie to investigate. Here is her enlightening report:

(1) *Shocking results*. GE's new CEO John Flannery hosted an investor day recently to explain why results have been disappointing and to give investors some guidance about what the future under his leadership might hold. One of the company's problem areas is its Power division, where operating profit is expected to fall by 20% this year and another 25% in 2018. The number of heavy-duty gas turbines it sells in 2018 is expected to drop to 65-70 units, which is down by about 30-40 units from this year, according to a transcript of the company's 11/14 investor presentation. GE's business of servicing its installed base of turbines is also under transactional and pricing pressure.

Russell Stokes, president of GE's power business, laid the blame on the impact renewables have had on the power market. "Look, we understand very clearly that the gas markets are challenged by renewable penetration, but we still believe that gas is going to be an important contributor to the energy mix going forward, even though we believe that we're going to see some significant declines on the need for gas and the utilization of gas in the short term."

Siemens recently announced plans to cut 6,100 jobs, or 13% of the workforce in its power and gas unit, which manufactures turbines for utilities. Siemens said that worldwide demand for new, large turbines has fallen to about 110 units a year, while manufacturers have enough capacity to supply 400 turbines. In the fiscal year ended September 30, profits fell in Siemens' power and gas unit.

Both companies find themselves with large exposure to the turbine market after making major acquisitions in recent years. GE's purchase of Altsom in November 2015 for $9.5 billion made power its largest division. Meanwhile, Siemens announced in May 2014 the $1.3 billion acquisition of Rolls-Royce's aeroderivative gas turbine and compressor business, followed by a $7.8 billion deal to acquire the oil and gas equipment supplier Dresser Rand in 2015.

(2) *Power glut*. An 11/16 article in *Handelsblatt* came up with two reasons for the glut: "When it comes to big power plants, a hoped-for global transition from dirtier coal to clean gas power plants has yet to materialize (perhaps that's why Siemens joined other German companies in demanding an end to coal power last week). And when it comes to renewable energy, many companies favor smaller, decentralized power solutions to the massive gas turbines that Siemens once thought were the future."

An 11/16 *WSJ* article concurred: "Siemens, like GE, has been caught unprepared for governments' and companies' shift away from large, fossil fuel-powered plants to renewables, which make electricity in a decentralized way and without the need to move massive amounts of steam through one of Siemens's mighty turbines. Meanwhile, gas-powered plants haven't picked up the slack from embattled coal and nuclear businesses as quickly as both Siemens and GE had anticipated."

The number of global coal plants that started construction in the 12 months prior to January 2017 fell by 62% compared to the year before, according to a report published by CoalSwarm, The Sierra Club, and Greenpeace. Likewise, the number of announced, pre-permit and permitted coal plants fell 48% in the 12 months prior to January 2017 compared to the year before.

The reduction took place primarily in China and India, which together represented 86% of the coal power built globally from 2006 to 2016. "Over 300 GW of projects in various stages of development were put on hold until after China's 13th Five Year Plan (2016–2020), including 55 GW of projects that were already under construction. A typical coalfired generating unit is 500 MW, or 0.5 GW, in size, with most power stations having two or more such units. In parallel with China's government-imposed slowdown, India also experienced a slowdown in coal plant development, driven primarily by the reluctance of banks and other financiers to provide further funds," the report stated.

(3) *Where's the growth?* The overcapacity in the power business is even more notable because it's occurring as the world's economy is growing. The US economy picked up steam this year, with Q3 GDP coming in at 3.0% (saar), following a nearly identical 3.1% during Q2 (*Fig. 1*). Meanwhile, global GDP growth should be 3.7% this year, according to the International Monetary Fund.

Historically, rising GDP growth has led to increased electricity usage as populations grow and generate more goods and services. But that hasn't been the case in recent years, particularly in developed countries.

The Energy Information Administration (EIA) attributes this new development to developed economies' shift toward service economies and away from manufacturing, which is more energy-intensive. "As more economic activity shifts from lower-skilled manufacturing to services and higher-skilled advanced manufacturing, additional economic activity can be generated without requiring as much electricity use," according to an 11/20 EIA report.

Indeed, the energy intensity of US manufacturing has been decreasing, according to a 10/19 EIA report. It states: "From 2010 to 2014, manufacturing fuel consumption increased by 4.7%, while real gross output increased by 9.6%—or more than twice that rate—resulting in a 4.4% decrease in energy intensity. … Although many manufacturing establishments are taking steps to reduce their energy consumption, the energy intensity decrease for total manufacturing is mostly the result of a shift of manufacturing output from energy-intensive industries, such as the manufacture of metals, chemicals, paper, and petroleum and coal products, to less energy-intensive industries. If major industries had maintained the same proportions of the manufacturing sector, the energy intensity decline between 2010 and 2014 would have been 0.7% instead of 4.4%."

As a result, electric demand among the OECD nations is expected to grow 0.9% annually, while non-

OECD countries are expected to show 1.9% annual increases through 2040, the EIA projects.

(4) *Not so fast*. If electric cars get adopted and go mainstream, this slow-growth prediction could quickly need an upward revision, estimates National Grid, which owns the UK's national transmission network for electricity and gas. In England, electric cars could reach 9 million by 2030, up from 90,000 in July. If that occurs, it could reverse the UK's falling electricity demand that resulted from increased efficiency of electric items. Demand could surpass the capacity of the Hinkley Point C nuclear power plant by 2030 if cars aren't charged at off-peak hours, warned National Grid, in a 7/13 article in *The Guardian*. GE and Siemens certainly hope so.

(5) *Charged up numbers.* The S&P 500 Electric Utilities index has had a respectable year, gaining 13.9% ytd (*Fig. 2*). The industry is expected to enjoy 3% revenue growth and 2.7% earnings growth over the next 12 months (*Fig. 3*). But despite the slim earnings growth, the industry's forward P/E has risen to 18.0, which is near the highest levels the industry has seen over the past 20 years (*Fig. 4*). Perhaps investors are instead focusing on the sector's dividend yield.

Going forward, the industry's fate may be determined by which grows faster: the electricity supplied by solar power or the demand for electricity to run electric cars. Had GE bought Tesla instead of Altsom, it would have been able to hedge its bet.

Disruptive Tech II: Lights-Out Factories. Robots should certainly be high on the growing list of items increasing demand for electricity. The number of robots populating factory floors continues to hit new records, as their benefits are hard to ignore. Robots didn't need to take a nap after Thanksgiving dinner. Nor do they want time off to go shopping on Black Friday. Let's take a look at some of the latest trends, which have humans both optimistic and fearful:

(1) *Record sales*. Global sales of industrial robots increased by 18% to $13.1 billion in 2016, according to an industry report by the International Federation of Robotics (IFR). That figure typically doesn't include the cost of software, peripherals, and systems engineering. If it did, the cost for the entire robotic system would be about three times higher.

Robot unit sales in 2016 increased by 16%, to 294,312, the fourth consecutive, annual record in unit sales. IFR expects sales to remain robust, increasing by at least 18% this year and by at least 15% on average per year from 2018 through 2020.

In 2016, five major markets represented 74% of the total sales volume of robots. The top markets are China, South Korea, Japan, the US, and Germany. Almost a third of all industrial robots are in China, and sales to that nation are far faster, at 27% in 2016, than to other countries. The largest users of robots are the automotive and electronics industries.

(2) *Partners, not foes*. Robots have become increasingly flexible and able to work alongside humans. Those that do are called collaborative robots, or "cobots," of course. A 5/5/16 *FT* article explained: "Traditionally, industrial robots have been locked behind cages, their heavy bulk and rapid movements making them unsafe for human interaction. They have required highly trained programmers to set their tasks and, once installed, were rarely moved.

"Now, a lighter weight, mobile plug and play generation is arriving on the factory floor to collaborate safely with human workers thanks to advances in sensor and vision technology, and computing power. Get in their way and they will stop. Program them with a tablet or simply by moving their arms in the required pattern; no coding is necessary. And if the robot is needed in a different part of the factory—unlike the heavy robotic arms that populate the world's automotive factories and are bolted to the

floor—they can be easily moved."

These cobots are much less expensive than the larger industrial robots. Their lower price point and greater flexibility may allow smaller companies to purchase cobots and accelerate their deployment.

(3) *Internet of Factories*. The number of robots deployed is expected to accelerate as factory floors use more sensors to get "smarter." Right now, sensors are being used for modest functions. For example, a Nokia plant in Finland uses humidity and temperature sensors to maintain the factory's automation environment, according to a 6/18 column in *Forbes*. Manufacturers can also place sensors on pallets of goods to track the goods' location, an 11/1 *FT* article reported. Sensors can also be placed inside transport vehicles and the final destination factory to track the arrival and departure of goods.

But these are just baby steps compared to the future that's ultimately envisioned. Some call it "Industry 4.0," where robots are integrated into factory-wide networks of machines and systems. "Robot manufacturers are already developing and commercializing new service models: these are based on real-time data collected by sensors which are attached to robots. Analysts predict a rapidly growing market for cloud robotics in which data from one robot is compared to data from other robots in the same or different locations. The cloud network allows these connected robots to perform the same activities. This will be used to optimize parameters of the robot's movement such as speed, angle or force. Ultimately, the advent of big data in manufacturing could redefine the industry boundaries between equipment makers and manufacturers," concludes a 9/29 article in Robotics Tomorrow.

Today, three people operate the above-mentioned Nokia factory. Ultimately, the company aims to have a "lights out" facility, where no human operators are required—and it can run with the lights off. We have no doubt it's just a matter of time.

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