SIMSA | Saskatchewan Industrial & Mining Suppliers Association Inc

January 3, 2024

Executive Director's Message

There has been an important shift in Saskatchewan's agricultural manufacturing landscape, that could have major implications for the industrial supply chain in general.

On December 20th, Guelph Ontario based Linamar (TSX: LNR) bought Saskatchewan's Bourgault for $640 million. Linamar does high end manufacturing and has an Innovation Hub.

Linamar has 26,550 employees in 65 manufacturing locations, 14 R&D centres and 28 sales offices in 17 countries in North and South America, Europe and Asia. The scale of their work can be seen in their Q3 results from November 8, 2023:

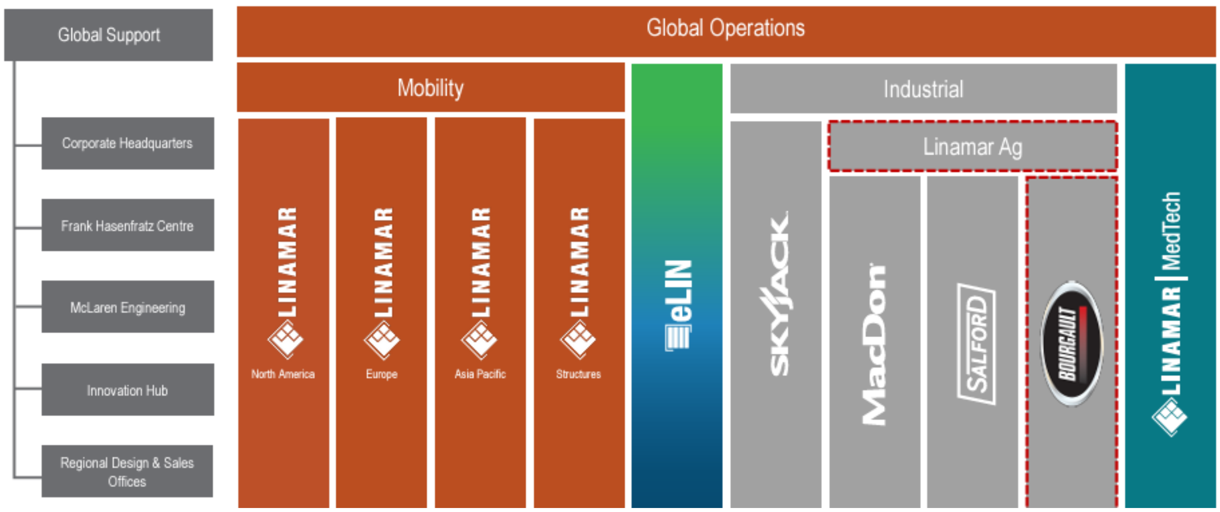
- Sales up 16.0% to $2.43 billion
- Normalized Operating Earnings up 19.0%
- Normalized Earnings per Share up 15.7%.

Linamar noted that this acquisition, further enhanced its industrial segment's diversified offerings and advancing its position as a leading short-line agriculture equipment manufacturer. Bourgault is a world-class agriculture equipment manufacturer regarded as a market and technology leader in broad acre seeding. Linamar's existing agricultural brands include harvesting specialist MacDon, and tillage and crop nutrition expert Salford. Bourgault is highly complimentary to these existing divisions and enables Linamar to increase its market position as it now possesses a full lineup of products in the broader crop production cycle, from field preparation, to seeding, crop nutrition, harvest and post harvest.

Bourgault will become part of a new Linamar Agriculture division within the broader Industrial Segment. The industrial segment also includes Skyjack, a manufacturer of aerial work platforms. This new Agriculture group will continue to operate the shortline brands of MacDon, Salford, and Bourgault independently while maximizing overall growth opportunities globally, better enabling future Agriculture technologies, improving the overall farm customer experience, as well as enhancing product support. The acquisition includes Bourgault's Highline Manufacturing division which produces hay handling and livestock feeding equipment, as well as roto-moulding producer Free Form Plastics.

Linamar Global Operating Structure:

Addition of Bourgault Creates New Linamar Agriculture Business Unit Within Industrial Segment



To further note about Linamar, they have 3 major divisions:

1. The Mobility segment is focused on propulsion systems, structural and chassis systems, energy storage and power generation for both the global electrified and traditionally powered vehicle markets, and is subdivided into three regional groups and one global product group: North America, Europe, Asia Pacific and the newly formed Structures Group. The Regional Mobility groups are vertically integrated operations combining expertise in light metal casting, forging, machining and assembly. This includes parts manufacturing for transmission, driveline, engine, and structure/chasis.
2. eLIN focuses on developing electrified product solutions for all business lines, developing electrification strategies in four key areas: Power Generation, Power Storage, Propulsion Systems, and Structural & Chassis offerings for electrified vehicles.
3. The Industrial segment is comprised of Skyjack, MacDon and Salford. Skyjack manufactures scissor, boom and telehandler lifts for the aerial work platform industry. MacDon manufactures combine draper headers and self-propelled windrowers for the agricultural harvesting industry. Salford also supplies the agriculture market with farm tillage and crop fertilizer applicator equipment.

Linamar's MedTech division leverages Linamar's manufacturing expertise and capabilities in precision manufacturing to provide high-quality, cost-effective solutions for Medical Devices and Precision Medical Components. Their leading-edge technology and deep manufacturing expertise make Linamar MedTech the ideal partner to manufacture and assemble complex medical devices and components. This includes:

- Precision CNC Machining
- Casting and Forging Capabilities

- Design for Manufacturing
- Complex Assembly

Linamar's Innovation Hub (iHub) is discovering solutions to global problems by partnering with aspiring entrepreneurial Start-ups/Scale-up to create a new future with products that are world leaders in technology, innovation and manufacturing. They help their clients to transform their businesses by launching innovative products that improve the lives of millions and the health of our planet. Their "One Team, One Linamar" approach provides access to deep manufacturing expertise, technical experts, and our vast global purchasing within the Linamar network.

McLaren Engineering is Linamar's leading-edge technology and product development team for their mobility segment. The foundation for Linamar's technical advancements is rooted in the expertise of McLaren Engineering. Purchased by Linamar in 2003, McLaren provides design, development, integration, manufacturing, and testing capabilities that provide their customers a world-class, full-service supplier partner that develops complete vehicle powertrain & driveline systems for both the global electrified and traditionally powered vehicles.

SIMSA has met with Linamar in the past and will again in the very near future.

Tradeshow booth demand for the 16th Annual Saskatchewan Mining Supply Chain Forum was huge; the tradeshow sold-out on November 21st at 2:00 pm and we had over 50 companies on the waiting list for more booths in early December. As such, we re-structured the tradeshow layout and added 46 more booths, which brings the total to 377. There will be 25% more time for the tradeshow this year!

The event will take place on April 17 and 18, 2024 at Prairieland Park in Saskatoon, SK. The mining companies expect to use 12 booths this year, which 50% more than last year – which is great! They have all spoken-up early this year that they want in.

The high-level 2024 MSCF Draft Agenda is:

- Tuesday, April 16
  Tradeshow set up (no set up permitted on April 17)
- Wednesday, April 17
  Speakers will be 8:00 - 12:00 (subject to change)
  Tradeshow open 10:00 – 6:00
- Thursday, April 18
  Speakers will be 8:00 - 12:00 (subject to change)
  Tradeshow open 10:00 - 4:00

Member's News

Schneider Electric Canadian Competency Center Supporting Saskatchewan in the Cobot Applications

SaskPolytech is proud to be part of the new GIEMS, Global Institute for Energy & Mines

Hiring in Canada, SK startup Immigrate unveiled cutting-edge platform revitalizing local communities

Peter Lucas Service Expansion to Include PMO and Engineering Services

Mentorship for Women in Non-Traditional Environments at Peter Lucas

Advocacy

In 2024, SIMSA will be assuming a lead role in labour force development. We have witnessed increasing demand in the mining sector and with the forthcoming nuclear expansions, labour force will be one of the top issues.

As such, SIMSA will be pulling together key stakeholders in an effort to coordinate and make efforts efficient.

Nuclear

Nuclear Power Plant Supply Chain – Supply Categories

Global supply chains for nuclear power plants can be divided into three categories: global supply, regional supply and local supply. Features of these categories are described below.

Global Supply

- highly complex equipment with highest level of quality requirements
- very large capital investment in manufacturing facility required (billions)
- long lead time for delivery (4+ years)
- IP typically held by supplier
- includes largest and heaviest components (> 5 m diameter, > 400 tonnes)

The high level of complexity is related to the complexity of the engineering design and interaction with the regulator (Canadian Nuclear Safety Commission) during the licensing process.

Examples of very expensive capital equipment are: forging presses, advanced welding systems, heat treatment facilities, advanced machining systems, advanced non-destructive inspection facilities, high speed balancing facilities and the land and building structures that enables the operation of this equipment. Examples of components in this category are: reactor pressure vessel, reactor internals, steam turbine rotors, generator stators and rotors

Regional Supply

- complex equipment with high to moderate level of quality requirements
- some components require large capital investment in manufacturing facility (millions)
- some components have long lead time for delivery (3+ years)
- some components require detailed design engineering

The complexity of equipment is related to engineering work that is required for a specific site location. Examples of high cost capital equipment are: advanced welding systems, heat treatment facilities, advanced machining systems, advanced non-destructive, advanced assembly facilities, and the land and building structures that enables the operation of this equipment.

Examples of components in this category are: fuel assemblies, steam turbine casings and valves, heat exchangers, engineered pumps and valves, water treatment systems, electrical packages, transformers

Local Supply

- typically have commercial level of quality requirements
- capital investment typically not required
- standard lead times for delivery

Examples of equipment in this category are: HVAC systems, light duty cranes, plant piping, pumps, structural supports, tanks and valves.

Industrial Concierge Update

We recently had a lunch and learn on gas heat pumps from Yanmar (message me for the slides). They offer a compelling case for the best of both worlds, emissions reduction and cost reduction. The biggest saving come with a heating/cooling/hot water combinations.

Saving Money with Gas heat pumps

Gas absorption heat pumps are gaining popularity in heating technology that can help commercial and industrial organizations save money, reduce energy use, and lower greenhouse gas emissions. Unlike traditional furnaces, heat pumps use energy to transfer heat from one area to another.

What is a Gas Heat Pump and why should you care?

Gas absorption heat pumps capture heat from the gas generator powering the heat pump and the ambient outdoor air as an additional energy source and transfer it indoors to provide space heating, hot/cold water, and/or ventilation. By transferring heat, the energy output is **greater than the energy input**, which is why gas heat pumps can achieve efficiencies of more than 100 percent. These units can reduce energy use by up to 35 percent and maintain optimal efficiency levels in colder climates, helping organizations save money and energy year-over-year. Gas absorption heat pumps can also reduce emissions by up to 50 percent when switching from standard-efficiency natural gas equipment.

What do they Cost?

The gas absorption heat pumps range in price and cost between $15,000 to $20,000, depending on factors such as installation, piping, and insulation costs. However, this technology offers a cost-effective solution for organizations looking to decarbonize their operations without having to switch to electric heating. Lastly, they require only single phase power (vs at least 2 phase for normal AC) and can reduce the demand charges you pay during the summer.

Do they work in Canada?

FortisBC piloted Robur A gas absorption heat pumps at seven commercial sites across British Columbia to verify energy savings, and results showed organizations could achieve up to 35 percent in energy savings. The company has also been working with 17 organizations through an early adopters offer to install gas absorption heat pumps in their facilities. These organizations include healthcare centers, a university trade and technology center, multi-unit residential buildings and schools, a recreational center, and a fire hall. FortisBC will work with these organizations over the next two years to verify energy savings and evaluate additional ways organizations can maximize energy savings.

There are also other installations across Canada, with one in Alberta, with great ROIs over the course of the system.

Are they reliable?

Gas heat pumps have been around since the 60s, and have a track record of reliability and durability:

- Long Life
- No compressors or engines
- No mechanical wear and tear
- Less moving parts
- No refrigerant leaking
- Low maintenance required
- Completely sealed refrigerant circuit - no need to periodically recharge refrigerant

What are the best applications:

Typical GHP Applications:

- Space Heating Only
- Space Heating & Domestic Hot Water Heating
- Domestic Hot Water Heating Only

Alternating Heating & Cooling Special Applications:

- Simultaneous Heating & Cooling
- Process Applications
- District Heating or Cooling

See here for more information from FortisBC:

https://www.fortisbc.com/news-events/stories/what-are-gas-heat-pumps-and-how-can-they-save-money-and-energy

Or:

https://consortia.myescenter.com/GHP/GHP_Workshop-Overview-ESC-110922.pdf

or contact james.bulmer@simsa.ca for more information.

Sector News

Cameco's acquisition of 49% of Westinghouse has some very strong implications for Saskatchewan, as Brookfield (an investment house) owns the other 51% - so Cameco becomes the real operator. Given Cameco's legacy of supporting our province, it is expected that some Westinghouse work will land in Saskatchewan. This becomes very interesting when "what Westinghouse is" is considered.

The segment below is the entire story, "A US Nuclear Revival — and Net Zero — Depends on Westinghouse." The story if from December 3, 2023 at https://www.bloomberg.com/opinion/features/2023-12-03/westinghouse-is-key-to-a-us-nuclear-revival-and-net-zero-climate-goals

We usually include only a portion of the story, but to retain context the entirety is included below.

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Along a corridor in Westinghouse Electric Co.'s nuclear fuel factory, not far from Columbia in South Carolina, a giant map of the world adorns the wall. Dotted across it are colored labels denoting the US company's customers. These are the power plants to which Westinghouse delivers batches of atomic fuel.

Traditionally, most were in North America and Western Europe, with some in the more far-flung regions of Asia. There were fewer in Central Europe or the former Soviet Union. That was Russian territory, dominated by the old Soviet nuclear giant, Rosatom. In recent years, however, Westinghouse has started filling in that section of the map.

First came Ukraine in 2014, when the state nuclear utility, Energoatom, scrambled to offset its almost total dependence on Rosatom after Russia's seizure of Crimea. Then, more recently, the switching accelerated. The Czech state-owned utility, CEZ AS, announced it would replace Russian fuel at its Temelin and Dukovany stations. Soon after, Bulgaria and Finland said they were switching too.

Customers aren't moving their business out of convenience or to save money. Changing nuclear fuel suppliers is time-consuming, and Westinghouse fuel isn't cheap. The reasons are geopolitical: a lack of trust in Russia's bona fides, magnified dramatically since February 2022 when Moscow launched an all-out assault on Ukraine.

Down in the South Carolina factory's cavernous main hall, where workers are constructing the tall latticework towers that hold the reactor-powering fuel, some are already working on distinctive ones for Russian-built reactors. Until now, these have been made in Westinghouse's plant in Sweden, but more capacity is needed. Given the surge in orders, the learning process has necessarily been swift, explains Karen Gay, a plant spokesperson. "It went from a two-year-down-the-line thing to a now thing," she says.

Ukraine and the Net Zero Imperative

Roll back a few years and the idea of Westinghouse as some sort of Western champion juggernauting into Russian export markets would have seemed preposterous. In 2017, the company filed for bankruptcy after running up some $7 billion of losses on two nuclear contracts in the American South. The first big deals it had won at home in a generation, these involved a new large reactor, the AP1000. One of the contracts was abandoned after $9 billion had been spent, and the customer's chief executive was subsequently jailed for fraud.

For a company that had once driven the development of commercial nuclear energy — building America's first atomic power station in 1957 and then around a fifth of the world's 440 operating civil reactors — it was a humiliating comedown. When, in 2018, Westinghouse was purchased from its previous owner, Toshiba Corp., for $4.6 billion by Brookfield Asset Management Ltd., a giant Canadian fund manager more associated with commercial real estate than atomic engineering, there was even talk of it abandoning new nuclear development altogether. That would have left the US without a large reactor maker for the first time since the dawn of the atomic age.

The surgery was ultimately less radical. Under Patrick Fragman, a French engineer who had once worked for France's nuclear safety agency, the new management cauterized the wounds left by Toshiba's ill-advised growth dash. Instead of building reactors from scratch, Westinghouse would just supply the designs and install components. Finishing the surviving US project — at the Alvin W. Vogtle plant in Georgia — would prove it could bring an AP1000 into commission in America. "Countries didn't want to touch new build programs with a 10-foot pole at the time," Fragman says. "But I was saying that the facts are stubborn: There is no way we will get to net zero without having some sort of nuclear component in many countries."

That toehold now looks potentially very valuable. The US Department of Energy recently estimated that to reach its decarbonization goals, the US would need to triple its nuclear capacity by 2050 to around 300 gigawatts. Vladimir Putin's invasion of Ukraine, meanwhile, has transformed the need to move away from fossil fuels into something urgent: a now thing, not a one-to-two decades down-the-line thing. Nuclear energy — long out of favor — has re-emerged as the only zero-carbon and reliable baseload alternative for European countries seeking to wean themselves off the drug of Russian gas or dirty, carbon-belching coal.

For Westinghouse this means more than just a rush of orders. It opens dizzying visions: a way back from perdition to the front rank of nuclear suppliers in a reinvigorated industry. As one of the few Western companies with all the pieces in place — a reactor licensed and ready to sell with examples already in operation, and a big fuel-making business — it is critical to the West's efforts not just to rebuild its nuclear infrastructure, but also to deprive Russia of a vital source of power and income and to strengthen the transatlantic alliance.

Yet Westinghouse is very far from turning this dream into reality. Its recovery is lopsided and confined largely to the servicing business. That bustle and optimism have yet to transfer to the new reactor side — and for deep-seated reasons. Years of inertia have denuded the company of capital, skills and willing customers. While rhetorically committed to building new nuclear plants, policymakers in Washington have yet to grasp the sheer difficulty of getting reactor construction moving domestically. That will require a wholesale reboot of the compact between the state and industry — what you might call the nuclear-industrial complex. Without it, Westinghouse will continue firing solely on one cylinder, and the odds of America, and the West, missing its climate targets will soar.

An Industry's Rise and Fall

About an hour's drive east of Nashville, Tennessee, a giant lone cooling tower looms above a line of trees. This is almost the last physical manifestation of the Hartsville atomic station. Once intended to be the world's largest, it was to have four giant reactors pumping out 5,000 megawatts — enough to power around 3 million homes. Then in the early 1980s, after oceans of concrete had been poured, its owners, the Tennessee Valley Authority, decided there would be insufficient customers for Hartsville's colossal output to make it viable. First, two of the reactors were scrapped and then, in 1984, after $700 million had been spent, the project was abandoned. These days part of the site is occupied by the Trousdale Turner Correctional Center. For the rest, the owners are turning it into a business park.

Hartsville's story is in miniature that of the wider US civil nuclear business. Possessed of lavish federal support in the 1950s, the industry flourished under the benevolent gaze of Congress, feeding off the fruits of US military research. Westinghouse's first commercial reactor, at Shippingport in Pennsylvania (also the first in America), started life as the power plant for an aircraft carrier, repurposed after President Dwight Eisenhower's "Atoms for Peace" speech in 1953, which was intended to seize the high ground in the intensifying nuclear rivalry with the Soviet Union.

A period of intense technological excitement followed. Utilities bet on new reactors, buoyed by the public's seemingly endless demand for more electricity. Then came the 1970s downturn. Dogged by mounting construction costs and environmental red tape, nuclear lost its luster. Washington's response to the energy crises of the mid-1970s was not to follow European nations such as France and Sweden down the path of strategic nuclear-building programs, but to hold off providing federal assistance. As a result, America's investor-owned utilities found themselves wrestling with reactor orders that were unviable given slumping electricity demand growth, and the soaring cost of financing. More than 75 US projects were abandoned between 1978 and 1985, including 28, like Hartsville, in mid-construction. Even before the Three Mile Island accident, the nuclear spell was broken, leading to a dearth in American orders that would span more than three decades.

Not even rising concern about the climate could arrest the downward spiral. A brief comeback in the 2000s, largely in response to high fossil-fuel prices, did little to reverse the loss of industrial capacity. The rise of fracking and its attendant cheap gas stubbed out any chance of rebuilding it in America. And in March 2011, the tsunami that engulfed Japan's Fukushima plant and ensuing meltdowns shuttered the country's nuclear reactors, casting a seemingly terminal pall over the global industry's prospects.

The Return of Leviathan

Ironically, it was President Donald Trump who called time on the shambolic years of leaving nuclear to free markets. Not, it should be said, out of any great concern about the climate; his interest was geostrategic, and even crudely mercantilist. But his administration was the first to sound the alarm about the state-backed push by Russia and China into the global nuclear energy sector. This posed a "significant risk" to the US economy, energy security and national security, as well as that of allies, it warned.

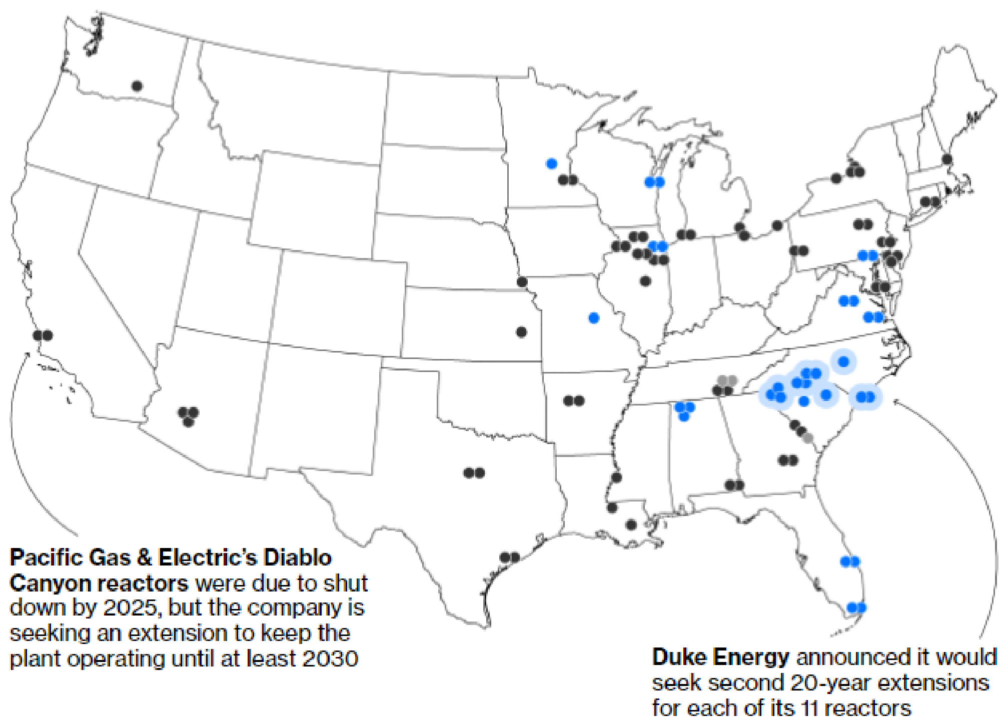
The first attempts to halt the slide focused on keeping reactors open — especially in the US where 13 had closed in the decade since 2013 on economic grounds. Incentives were introduced to offset low gas prices. Regulators started extending reactor lives out to 80 years — at least twice what many were originally designed for — to bridge the gap before new plants were built. And after President Joe Biden took office in 2021 the nuclear embrace tightened. He junked his predecessor's climate denial, rejoining the Paris Agreement on climate change on day one and returning emissions targets to the agenda.

The US Is Extending the Lives of Old Reactors

Six reactors have received extensions for up to 80 years, and operators of 25 more have applied for or announced they will seek the same renewal

Operating license status of US nuclear power plants

- Extension for up to 80 years, granted, applied for or expected
- Extension for up to 60 years, granted or applied for
- Original 40-year license

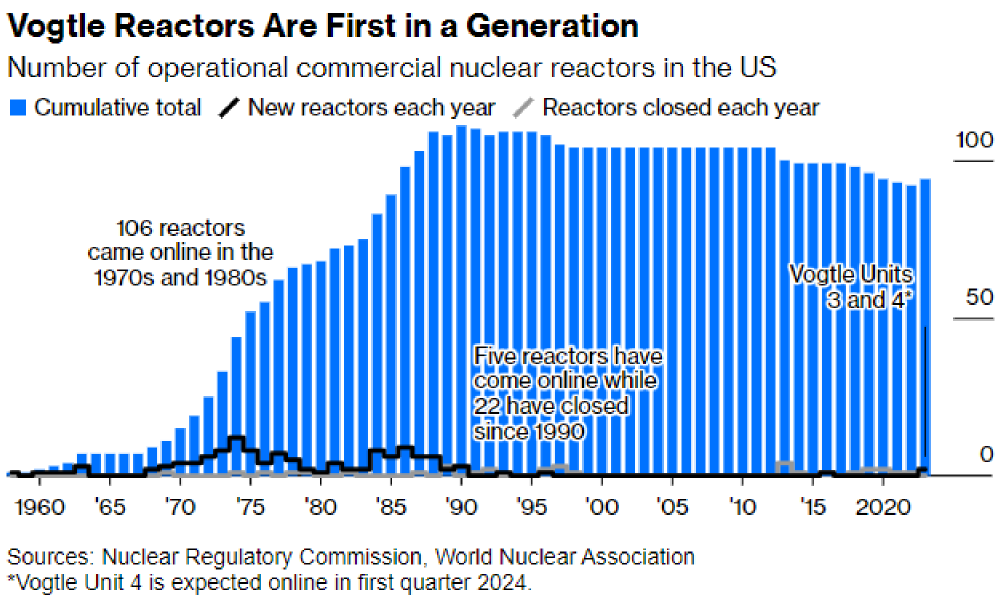


Sources: Nuclear Regulatory Commission, Nuclear Energy Institute
Note: PG&E has applied for 20-year extensions for two Diablo Canyon reactors in California but, to date, only plans to operate through 2030.

All this activity boosted the fuel and servicing side of Westinghouse, which accounts for roughly 70% of group income. Longer plant lives translate directly into higher revenues, especially when these involve massive refits designed to keep reactors going for another 20 years.

Its impact on new reactor sales was far more muted. Granted, as well as throwing an arm round old plants, Washington gave a push to nuclear exports. In an echo of "Atoms for Peace," the US pursued bilateral nuclear deals to promote Western sales, fighting back against Russia and China, which between them accounted for 75% of global reactor exports over the previous decade. It even found a way to overcome its historic aversion to offering financial support. There followed accords with several Central European countries which opened the door both to fuel deals and new reactor sales. In late 2022, Westinghouse was selected by Poland to build the first three units of a six-reactor scheme on the Baltic coast.

But there was no echo of this hubbub in Westinghouse's home market. Despite generous fiscal incentives, which showered tax credits on "clean" energy producers and lumped nuclear into that classification for the first time, American utilities remained on the sidelines. As of today, there are still no committed orders for new nuclear reactors in the US.



According to John Kotek, senior vice president at the Nuclear Energy Institute, a trade body for reactor-owning utilities, this doesn't reflect fundamental skepticism about atomic technology. Public support for nuclear is higher than it has been for decades, and utilities are acutely aware of the pressure coming not just from politicians, but from heavy electricity users such as Amazon and Google, to decarbonize. What really discourages utilities is the terrible record of building gigawatt-scale reactors. "The large price tag and long construction times associated with large plants are a big disincentive," Kotek says.

If They Come, Can You Build It?

Delays and budget overruns are not a new problem. They became the leitmotif of the so-called "Great Bandwagon Market" of the late 1960s and 1970s, when US utilities ordered most of the 94 reactors currently in operation. It was a time when construction costs rocketed, going up ten-fold in the decade to 1983 — more than three times the rate of consumer price inflation.

Part of it was a regrettable American tendency for each utility to commission idiosyncratic plant designs — sometimes almost unit by unit. Contractors had to learn to build them afresh each time. But a big reason was also the growing complexity of light-water reactors — a type pioneered by Westinghouse that had become the global industry standard. As these became ever larger to exploit the economies of scale in nuclear, the temperatures in the core mounted, raising the risks of a reactor-busting meltdown if the flow of cooling water was ever choked off. The solution was to install backup systems. But power-dependent pumps, valves and miles of pipework not only raised fears about their vulnerability to failure; they also made reactors increasingly difficult to build.

The promise of Westinghouse's AP1000 was to get round all this. Licensed by the US regulator around the turn of the millennium, it used passive safety systems that employed gravity and convection to cool it safely if ever something went wrong. The need for all those pumps, pipes and other potential points of failure was much reduced, making it far less prone to meltdown. As David Jones, a retired Navy engineer who runs the computer simulator used to train future AP1000 operators, told me, "People often ask me to do Three Mile Island," referring to the famous 1979 meltdown. "But I say, 'I can't do it.' You couldn't have that sort of accident at a passive plant." The AP1000's simplicity also permitted the design to be modular, meaning parts could be manufactured offsite in blocks.

Westinghouse pitched these virtues when it persuaded some Chinese and US utilities to buy AP1000s in the early 2000s. Indeed, so confident was it of its smart new design that it agreed to build Vogtle as a turnkey project, taking all the construction risk. The Chinese units went up without undue mishap and have since set "world records for operational performance," according to the head of the new reactor business, David Durham. But the domestic experience was little short of disaster. Of the four US reactors ordered, two were canceled in mid-construction, and only one, at Vogtle, has been completed. That was connected to the grid only in recent months, seven years late and at vastly inflated cost.

What went wrong? Partly it was Westinghouse's own folly: It rushed to construction on the reactors before finishing the design. But the failure also stemmed from a loss of nuclear knowhow. For instance, most of the modular parts were produced by Shaw Group, an industrial pipe maker from Texas with no nuclear experience, whose output was plagued by substandard workmanship and defective welds.

What made it all worse was the company's blithe expectation that construction would be a breeze. History suggests quite the contrary: that "first of a kind" nuclear plants rarely go up without some hitch. Reactors are, after all, complex beasts, and contractors have to learn the hard way how to build them. The payback only comes when those clued-up workers build fleets of similar units, perfecting the supply chain that allows for consistent delivery and more efficient techniques. (In a recent paper, the US Department of Energy estimated it might take "10 to 20 reactors" for the optimal point to be reached, with each successive unit before then costing steadily less.) It is why South Korea, having built programmatically since the 1980s, can throw units up for $2,000-4,000 per kilowatt of capacity, against close to $10,000 for Vogtle 3.

Having learned to build one AP1000, Durham believes Westinghouse is now poised to benefit from this same benign effect, although the gains will perforce be muted by the need to transfer hard-won knowhow across the Atlantic to Poland, and the promise made to Warsaw to source almost half the content locally. The plan is to smooth the process by sticking rigidly to the same reactor plans with each project. “Our attitude is very much that we will not change the design,” Durham says. “That is the key point everywhere we go.”

Yet none of this has reassured potential American buyers. The calamitous experience post-2008, which saw the fire sale of one of Westinghouse’s customers, Scana Corporation of South Carolina, to Dominion Energy, reminded utilities of the reasons they had pulled back from nuclear in the first place. Of the 15 US AP1000s licensed in the brief “nuclear renaissance” of the 2000s, no more were built, and eight permits simply allowed to lapse.

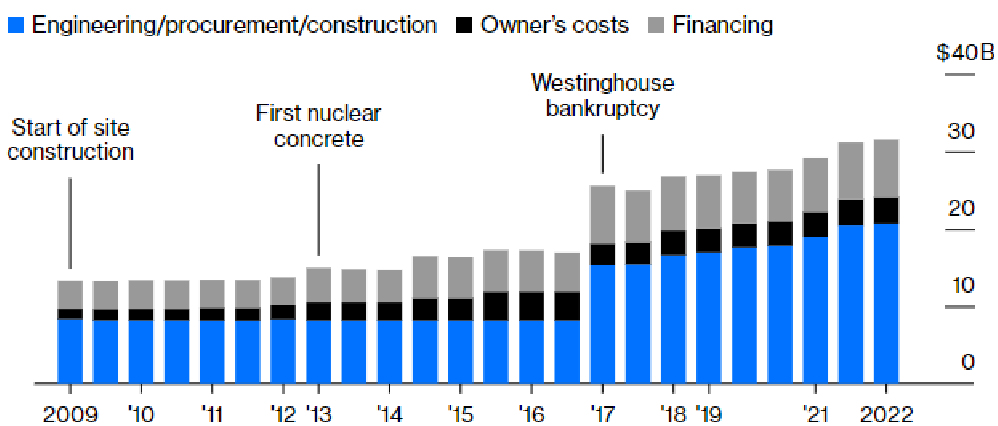
A Financing Catch-22

By the early 2020s, Westinghouse had put its losses behind it. What with all the extra servicing work, together with hopes of new reactor contracts, its value was rising. And last autumn its owner, Brookfield’s private equity unit, agreed to sell it to a sister fund, Brookfield Renewable, which specializes in wind, solar and hydro energy, and Cameco, one of the world’s largest uranium miners. The price was $7.8 billion — almost twice what Brookfield had paid four years previously.

The number seems impressive, at least until you consider the financial risks in gigawatt-scale reactor contracts. The overruns on one deal alone — the $14 billion contract for the twin reactor Vogtle plant — may end up topping $17 billion. A scheme by Electricite de France SA in Finland originally budgeted at €3 billion ended up costing between €11 billion-12 billion. “It shows you could in theory liquidate the entire company and not deal with a single Vogtle-style hit,” says Tim Stone, the head of Britain’s Nuclear Industry Association and former adviser to five UK energy secretaries.

One US Nuclear Plant’s Expensive Learning Curve

Overruns at Vogtle were driven by spiraling construction costs



Source: US Department of Energy, “Pathways to Commercial Liftoff: Advanced Nuclear”

The question of who should bear this risk is the biggest hot potato in nuclear construction. Understandably, Fragman is determined that the company won’t take any more than the minimum it can get away with. Westinghouse is, he points out, a vendor of reactor technology and not a construction company. “You do well what you do often,” he says. “If you asked GM or BMW to build a car every 20 years it will for sure be very expensive and take much longer than you expected.”

Meanwhile Bechtel Corp. — the engineering giant to which Westinghouse intends to delegate oversight of the Poland AP1000 project — is no keener to put itself on the hook. “There might be elements of risk-sharing in contracts based on the overall success,” says Ahmet Tokpinar, general manager of Bechtel’s nuclear business. “But these are cost-reimbursable projects, meaning the contractors cover their costs. That is the way the US built the 100 units it has today.”

The problem is that no one else wants to take the risk either. Utilities have good reason to be very cautious. Failed projects can lead to defaults, or situations where customers and investors end up with huge bills but no power station to show for it. The result can be a blitz of lawsuits against the company and its executives. In the 1980s, utilities such as Washington Public Power Supply System and Long Island Lighting Company collapsed after nuclear projects ran over budget or hit regulatory walls.

Only in Europe, where utilities are more likely to be national in scale and government-owned, is there a possible recipient in the shape of the taxpayer. Most willing are Central European states, which share a strong geopolitical desire to stop buying Russian hydrocarbons and to plant their nation firmly inside America’s nuclear tent, although Poland’s new government has recently called for Westinghouse and Bechtel to shoulder some of the risk by taking an equity stake of as much as 30% in the project, costing possibly $2 billion. (Claiming that they were “not the right partners” to invest in the deal, the US companies dismissed that idea.)

Even those Western European states that formerly privatized their utilities are now moving toward state financing. The UK, for instance, has established a government-owned vehicle, Great British Nuclear, to take stakes in the development of new reactors, while France has fully renationalized the nuclear energy side of EDF. It is why Durham regards the continent as his most promising market, with prospects bubbling in countries such as Czechia, Slovenia and Bulgaria. “Europe is committed to decarbonize,” he says. “The US is getting there as a country but it isn’t quite there yet.”

A Question of Size

America has been left trying to square the desire to build more nuclear plants with its longstanding phobia about federal taxpayers footing the bill. (Twice before, once in the 1950s and again in the 1970s, first Congress and then President Gerald Ford’s administration threw out proposals that would have permitted this to happen.)

As pressure mounts on utilities to invest in carbon-free generation, developers of so-called small modular reactors (SMRs) have seized on the financing catch-22 as an opportunity. Originally these were not seen as suitable for mainstream electricity generation; they were for specialist applications, such as powering industrial sites or remote communities. Indeed, Westinghouse is developing its own version of this idea, the five-megawatt eVinci micro reactor. But increasingly, developers pitch them as an alternative to large units such as the AP1000.

Smaller reactors naturally produce more expensive power than large ones. Their main selling point is the diminished risk of crushing overruns. With the promise of shorter lead times and comparatively low sticker prices of, say, $1 billion-$5 billion, SMR vendors such as GE Hitachi and NuScale Power Corp. argue they pose far less of a risk to utility balance sheets. “The theory is that a 20% cost overrun on a $1 billion project is a heck of a lot better than a 20% overrun on a $15 billion project," said Patrick White of the Nuclear Innovation Alliance, a think tank.

Although most designs are still years away from commercial development, deals are emerging, especially for GE Hitachi's BWRX-300, which has interest both from Ontario Power in Canada and the Tennessee Valley Authority. In May, Westinghouse abandoned its previous reluctance to jump on the SMR bandwagon and launched its AP300, essentially a scaled-down version of the AP1000. By using many of the latter's components, it hopes to rush the reactor into production by the end of the decade.

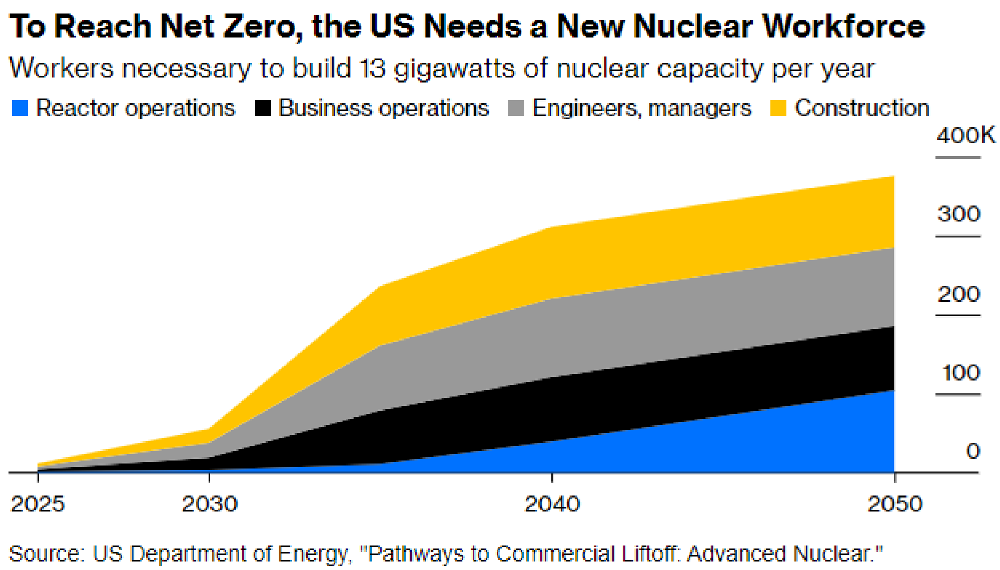
Whether SMRs are the "get out of jail free" card their proponents hope is unclear. Their prospect of breaking the doleful pattern of overruns is unproven. NuScale's project for a six-module 462-megawatt plant in Utah recently collapsed after its anticipated power costs doubled before construction even started, leading the utilities that would have bought its power to pull out. Its shares, listed in May 2022 after a merger with a special acquisition company, have declined by 75%.

Other projects remain years away from licensing approval, raising questions about whether SMRs will simply come too late to help the US hit net zero. The central premise, which involves the ability to factory-build standardized reactors in sufficient volume to drive down costs, is unlikely to be realized until the mid-2030s. According to Mike Hogan of the Regulatory Assistance Project, "We need to be most of the way down the road to decarbonization of the electricity system by then."

A Giant 'To Do' List

Whatever reactors are chosen, the US faces a massive task in rebuilding the sinews to construct them. In March this year, the US Department of Energy published a report looking at "pathways to commercial liftoff" for nuclear energy. This laid bare the holes in America's atomic infrastructure, from fuel enrichment capacity (whose lack is rendered more acute by Russia's banishment from the roster of acceptable suppliers) to the long-running failure to build a geological storage facility for nuclear waste.

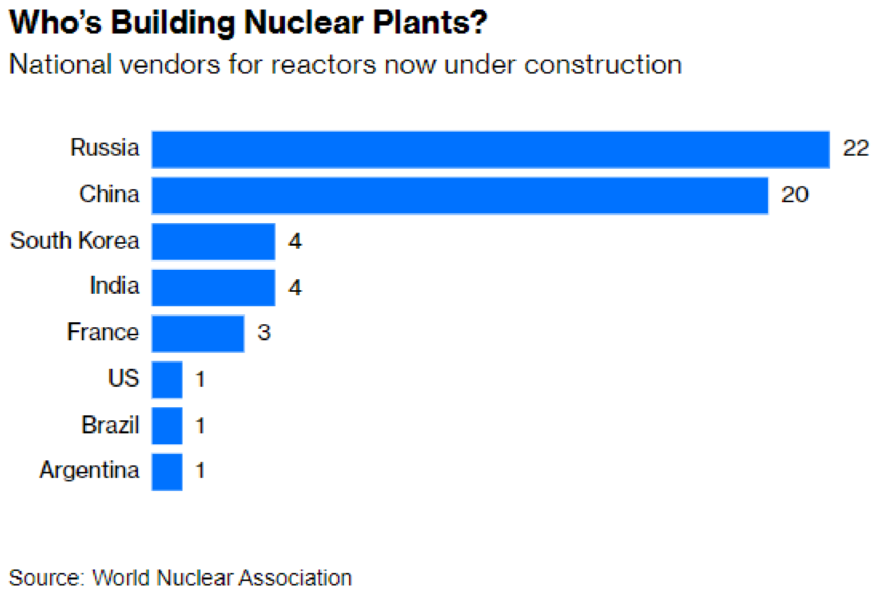
The requirements are staggering: For instance, the US will need an extra 375,000 skilled workers simply to build and run all those extra nuclear plants if the decarbonization target is to be met.



How is all this to be financed? Few expect a private sector bruised by past nuclear failures spontaneously to stump up to plug all the gaps. “To get private investment into nuclear, you need to make it very investor friendly,” says Darryl Murphy, head of infrastructure at Aviva Investors, who worked on the financing of Britain’s Hinkley Point C project, which is building two giant 1,650-megawatt EDF reactors in southern England.

The No. 1 necessity is certainty on policy to bring down the cost of capital — critical in an industry that requires huge sums upfront. Financing represents around 70% of the cost of nuclear per megawatt-hour. And that in turn means thinking more than one reactor project ahead. “You need to have a program so investors can see there is more coming down the line,” says Murphy. “It is hard to justify going through the whole process of getting comfortable with the sector just for one project.”

The biggest problem is time — or its absence. To build 200 gigawatts of nuclear by 2050, the US needs to start switching on new reactors by the early 2030s, with a sufficient pipeline to break through the “first of a kind” barrier and start driving down costs. Given the lead times involved, it is hard to see how this can be done without Westinghouse — the one US company with a proven type available on the market. (The only realistic alternatives are EDF of France, which is redesigning its EPR reactor, and AECL of Canada, which has never sold a plant in the US.) But critically, it also requires Washington’s direct participation. “All capital providers agree that the government would need to play a significant role for nuclear to take off in the next 10 years,” notes the Energy Department’s report.



Quite what form this could take remains unclear. Some of the ideas envisage direct financial involvement — from forking out federal grants to fund construction (with the most financial support going to first movers), to full government ownership. Another idea is to offer guarantees to purchase nuclear plants' output, the absence of which sank the NuScale scheme.

But a less contentious route might involve state-backed insurance for cost overruns — effectively a federal cap above a certain financial threshold. Structured to offer some shelter from Vogtle-scale bills on first-of-a-kind projects, these could unlock investment in the larger reactor designs now shunned by fearful utilities.

True, the scheme would require political sanction, the hurdle that tripped all previous attempts at federal financing. "A direct statute would be necessary from Congress to allow the US Government to fill this role," the Department of Energy notes laconically. But precedents exist: The Price-Anderson Act (1957) provides a cap on private insurance losses relating to nuclear accidents. Atomic energy is one of the few areas which commands bipartisan congressional support.

Without some solution, Durham thinks domestic orders will remain elusive, leaving the company stuck in an all too familiar doom loop. "You know, you build two units and then don't build any more for 20 years and lose all of that institutional knowledge," says Durham. "This time we need to keep building."

Start the Renaissance Without Me

For all the talk of future programs, there's no certainty that the nuclear industry's weary cycle of jagged stops and starts won't continue. When the workers finally down tools at Vogtle — hopefully next year — the project has no obvious successor, save for thousands of miles away in Poland, starting perhaps half a decade from now. In the meantime, Westinghouse is quietly becoming the business some expected when Brookfield acquired it: one where the share of new reactor revenues is steadily ebbing away.

From a purely commercial standpoint, a pivot toward servicing has some logic, offering the stability of long-term, inflation-linked contracts. Connor Teskey, boss of new owners Brookfield Renewable, likes to point out that servicing customers "never leave Westinghouse," adding that the firm has a "99% retention rate."

Compare that with the uncertainties involved in selling AP1000s in Europe or developing and licensing an SMR. "Basically, if Westinghouse screws up one of the Polish contracts, they will never sell a reactor in America again," says one consultant who declined to be identified.

Brookfield can sometimes sound ambivalent about the whole idea of building reactors. "Westinghouse does well if the nuclear fleet round the world just ticks along and doesn't change," observes Teskey. Growth in reactor numbers is viewed as "upside" — a windfall. Others however see it as more of an imperative. According to the US government, failure to start deploying reactors at scale by 2030 could lead it to miss its emissions targets, or force the industry to overbuild capacity wastefully simply to catch up.

Tim Stone worries about countries placing all their eggs in the SMR basket. "Any rational energy strategy should involve putting in gigawatt-scale reactors, together, in due course, with small ones whose cost of electricity is as yet unknown" he says.

Turning one's back on large reactors is a high-stakes gamble. "We are talking about the future of our countries in the 2050s and beyond. If we don't get it right, our economies will suffer."

Upcoming Events

Register for Upcoming Events HERE

- **DEMOday 2024 Launch Event – January 18, 2024**
  Meet with representatives from BHP, Cameco, Mosaic and Nutrien to learn about the industry's problems and needs.

- **Mining Hackathon Kickoff Event – January 19, 2024**
  We will be hosting a hackathon for the students of the University of Saskatchewan in response the needs outlined in the IMII's DEMOday.

- **Lunch & Learn: Honey Cut Studios – February 2, 2024**
  Discover how to craft engaging and insightful videos that will help your brand stand out!

- **Saskatchewan Mining Supply Chain Forum (MSCF) – April 17 & 18, 2024**
  The 16th Annual Saskatchewan Mining Supply Chain Forum will take place on April 17 and 18, 2024 at Prairieland Park in Saskatoon. Tradeshow and sponsorship now sold out!

- **SIMSA AGM – May 15, 2024**
  Save the Date! The SIMSA AGM will be on May 15, 2024 at Prairieland Park in Saskatoon.

- **Saskatchewan Suppliers Energy Forum (SSEF) – October 2, 2024**
  Save the Date! The 10th Annual Saskatchewan Suppliers Energy Forum will be on October 2, 2024 at the Delta Hotel in Regina.

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