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Could an Industrial Finance Corporation Help the United States Succeed with Clean Tech Manufacturing?

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The United States is historically one of the world's largest investors in renewable energy research and development (R&D). Yet, it has struggled to build a large manufacturing industry for the technologies needed in a clean energy transition.[1] U.S. universities and startups have excelled at inventing new technologies, but much of the global production capacity in these sectors is located elsewhere. As the U.S.-China relationship continues to erode, the U.S. needs to improve conditions for segments of clean energy supply chains that are currently not well-supported domestically. A key reason for the lack of domestic clean tech manufacturing has been the scarcity of capital among clean technology firms. Clean energy startups have struggled to raise sufficient funds to invest in domestic manufacturing capacity. American financial institutions have prioritized industrial sectors—including software—that have yielded higher and faster returns.[2]

A proposal by a group of U.S. Senators to establish an Industrial Finance Corporation of the United States (IFCUS) aims to change that.[3] Their proposed IFC Act would establish a government-owned corporation providing capital to small and medium-sized manufacturing businesses in critical industrial sectors. Currently, it faces legislative obstacles: the proposal was initially included, but subsequently removed, from the 2021 reconciliation bill. Also, the financing needs of clean tech manufacturers are not included in current proposals to create a National Climate Bank, which would focus on funding the *deployment* of clean energy technologies and investments in infrastructure, not the production of such products.[4] Still, the basic idea of an Industrial Finance Corporation could be revived by a subsequent Congress. Doing so would bring significant benefits.[5]

This research brief explains why political leaders regularly promise domestic manufacturing jobs in clean energy industries, lays out the reasons why such promises have rarely been met in the past, and assesses the IFCUS as a way to deliver on such promises. Establishing an organization akin to a state-owned development bank for manufacturing is essential if the United States wants to increase the share of clean energy technologies manufactured domestically.[6] Doing so would help increase the number of jobs in clean energy industries, bolster middle-class employment, help build a broad political coalition in favor of action on climate change, and reduce dependence on China in clean energy supply chains at a time when the U.S.-China relationship has come under significant stress.[7][8]

The Industrial Finance Corporation

On August 12, 2021, a group of Democratic Senators introduced the Industrial Finance Corporation Act, which proposed the establishment of a government-owned organization—IFCUS—that would finance high-tech manufacturing in the United States. The announcement emphasized that the United States had historically led in the development of new technologies due to large injections of public and private capital. The proposal stated that the United States long lacked appropriate financial institutions to support the development of manufacturing capacity to commercialize and manufacture new technologies. Because of long investment horizons, significant upfront investment costs, and technological risks associated with the commercialization of new technologies, private investors shunned investments in domestic manufacturing, particularly in industrial sectors central to combating

greenhouse gas emissions such as clean energy, batteries, and high-voltage transmission. The announcement further states that a state-run finance corporation would not crowd out the private sector since private financial institutions have historically avoided these industries.

The Industrial Finance Corporation Act proposed to fund IFCUS with a one-time capitalization of $50 billion, which could generate hundreds of billions of loans and equity investments.[9] IFCUS would be a government-owned but independent organization tasked with supporting domestic supply chains in critical industries, focusing on the commercialization of U.S.-developed technologies, and prioritizing the capital needs of small and medium-sized manufacturers in traditionally underfunded industrial sectors including clean energy.[10] As such, IFCUS is intended to bridge the "valley of death" typical in industries at the technological frontier, which describes the gap between a startup company's successful technical innovation and the commercialization of that innovation.[11] Unfortunately, many startups fail to secure sufficient financing to sustain their commercialization and manufacturing efforts until profitability.

IFCUS was initially included in the 2021 reconciliation bill as part of the $3.5 trillion infrastructure package. However, the proposal ultimately failed to gain sufficient political traction and was eventually written out of the bill in September 2021.[12] Despite this setback, the proposal presents the first concrete industrial policy attempt to resolve a longstanding gulf between political promises of green manufacturing jobs and the economic reality in the United States.

The Political Logic of Green Growth

American policymakers—just as their counterparts elsewhere—have long justified investments in new energy technologies with the promise of domestic economic returns. Particularly, the creation of clean energy manufacturing jobs—long associated with good-paying, middle-class, and unionized employment—has been a popular rationale for investments in climate policy.[13]

The connection between climate policy and the promise of economic benefits follows a broader political logic in the United States and elsewhere. Public investments in creating industries that can invent, manufacture, and possibly export wind and solar products allow governments to strategically position their domestic economies in sectors with future growth potential.[14] Beyond the economic benefits, policies that promise to support growth and employment are also attractive to policymakers because they create political coalitions organized around climate policy. Climate and energy policies that achieve emissions reductions while simultaneously creating new sources of growth are easier to implement politically than subsidies for clean energy products imported from abroad.[15] Policies that seek to combine industrial development and emissions reductions also provide an opportunity to create new interest groups in support of energy sector transformation.[16]

In other countries, these interest groups have been crucial for generating the type of broad support for climate policy measures that is particularly important for initiatives that entail large public expenditures, including clean energy R&D programs and subsidies for creating renewable energy and electric vehicle markets. In Germany, for instance, coalitions of small and medium-sized producers of wind turbine and

solar PV components have been critical to the continued support for domestic renewable energy markets.[17]

To deliver on the promise of green economic growth, many energy and climate policies at the state and federal levels have included stipulations that directly aim to attract economic activity. Such measures include, for instance, preferential loans for renewable energy projects that require wind and solar equipment to be manufactured locally, renewable portfolio standards that require a percentage of renewable energy to be generated in-state, or provisions to use locally-manufactured solar panels and wind turbines. A 2015 survey found at least 44 renewable energy programs in 23 states that contained local content requirements, often violating international trade rules.

Cleantech Manufacturing in the United States

Despite policymakers' promises of domestic clean manufacturing, American firms in clean energy sectors have historically focused on inventing new technologies, frequently without establishing mass manufacturing capabilities. Such a focus on invention also occurred in the solar and battery industries, where little manufacturing capacity exists in the United States.[18] But even in the wind sector, where weight and size considerations have made global shipping costly and impractical, local content rates in the United States has long trailed those of other economies with similar domestic wind energy markets.[19]

A critical reason for the lack of cleantech manufacturing is institutional. The United States has long had excellent federal programs to fund R&D and enable technology spin-offs. Still, it has lacked a financial sector willing to invest in large-

scale manufacturing capacity in new industrial sectors, particularly those reliant on government regulation for market demand. Throughout the 1990s, the absence of stable subsidies for the large-scale deployment of renewable energy technologies in the United States made it difficult for cleantech firms to generate revenue from their products. Not surprisingly, financial institutions, particularly venture capital funds, resisted funding long-term R&D without a clear prospect of market demand. Without government subsidies, even advanced wind and solar technologies were not cost-competitive with fossil fuels.[20]

This situation changed when government policies in the United States and elsewhere created a growing demand for renewables in the early 2000s. The percentage of government R&D funding as a share of overall investment in solar energy technologies dropped from 90 percent in 2001 to less than 10 percent in 2007 as private investment increased exponentially.[21] Global venture capital investment in clean energy technologies multiplied from $200 million in 2000 to $2.5 billion by 2007; U.S.-based venture capital funds investing in U.S. startups accounted for 82 percent of overall VC investment in renewable energy. Some 150 renewable energy startups received venture capital funding in Silicon Valley alone.[22]

But venture capital funding for the renewable energy industry remained insufficient to meet the capital needs of cleantech manufacturing, where individual plants can require hundreds of millions of dollars in upfront investment. After peaking in 2008, venture capital investment decreased, dropping to $2 billion by 2013. Increasingly, venture capital funds focused on later-stage technologies and avoided early-stage projects with long development horizons, uncertain future payoffs, and returns unlikely to match those of other industries.[23]

Faced with the choice between long-term investments in the commercialization of clean energy technologies and short-term funding of tech companies with the promise of higher returns (and more minor capital needs due to the absence of physical manufacturing facilities), American financial institutions have frequently chosen the latter. For venture capital firms, for whom most high-risk investments will ultimately fail, successful investments must be enormously profitable and justify the overall investment portfolio. Unfortunately, investments in cleantech manufacturing have often failed to surpass the overall success rate achieved in other sectors, such as software. Cleantech manufacturing has had more significant capital needs to build physical manufacturing assets and lower profitability even in the most successful cases. It has rarely yielded the lucrative valuations achieved in other tech sectors.

Against such waning enthusiasm and widespread doubt about the ability of energy startups to produce the returns and time-horizons standard in the software industry, clean technology firms have frequently failed to raise funds required to bring their technologies to market.[24] Ultimately, many firms have failed to bridge the "valley of death," unable to secure sufficient long-term funding in the commercialization of new technologies to reach profitability. While some simply went bankrupt, others were bought up by foreign multinationals that subsequently commercialized their technologies elsewhere.[25] For example, Chinese investment in U.S. startups increased by more than 180 percent between 2013 and 2015, including through purchases of U.S. thin-film solar and battery technology firms.[26] Struggling to scale domestic manufacturing, other U.S. startups simply licensed their technologies to manufacturing partners in China.[27]

The situation was different in economies where state-owned development banks offered preferential loans to clean energy manufacturers. In China, the state-owned China Development Bank reportedly extended $42 Billion in credit to wind and solar manufacturers in 2010 alone.[28] Germany's KFW bank, a government-owned development bank initially established to fund post-war reconstruction, long featured designated low-cost, long-term loan programs for small and medium-sized manufacturing firms, including in clean energy sectors.[29] Germany's traditional system of local credit unions was also willing to provide patient capital to local manufacturers at rates of return below those expected by American venture capital funds. As a result, China soon dominated global manufacturing for wind turbines, solar panels, and lithium-ion batteries. At the same time, Germany's SMEs focused on exporting production equipment for China's rapidly expanding clean energy manufacturing plants.[30]

Critics will question whether a government entity like IFCUS should be willing to accept lower rates of return on investments than those expected by private equity and argue that government involvement could crowd out private financial institutions. But such concerns are largely unfounded. The private sector currently underserves the manufacturing businesses targeted by the IFCUS proposal. And, unlike private equity, governments should care about the downstream benefits (i.e., positive externalities) created by these investments. Those benefits could include middle-class jobs in an economy that needs alternatives to the fossil fuel industry, more reliable supply chains, strategic competition with other countries' manufacturing bases, and interest groups in favor of pro-climate policies.

The proposed IFCUS would not be the first time the government intervened in financial markets to create positive externalities. For instance, Fannie Mae was established as a government-sponsored enterprise to broaden access to homeownership by introducing long-term fixed-rate home loans that private banks had not previously offered on their own. Similarly, the U.S. Export-Import (ExIm) bank has provided export financing and loan guarantees for private businesses since the 1930s, when private lenders were unable or unwilling to step in. The ExIm bank offers export financing services for small and medium-sized enterprises and large multinational corporations—like Boeing—that seek to secure export deals.

Even on purely financial grounds, it is worth noting that the U.S. private sector has often underestimated the benefits of clean tech manufacturing. For instance, Ford sold Volvo to the Chinese-owned company Geely for $1.8 billion in 2010. Subsequently, Geely turned Volvo into an electric vehicle manufacturer. When Geely listed some of its Volvo shares for public sale in October 2021, the share prices implied a value of roughly $23 billion for the company.[31] Thus, Geely has made a massive profit on its purchase of Volvo. Conversely, Ford missed a huge opportunity based on clean tech manufacturing. An IFCUS might help future American businesses better capture the potential of cleantech manufacturing, particularly among smaller firms that are currently struggling to raise funds required to retool their plants for clean energy sectors.[32]

Can IFCUS Bridge the Valley of Death?

The Industrial Finance Corporation Act would offer a solution to the industry's financing problem, setting up a financial institution targeted explicitly at funding manufacturing firms in critical industrial sectors. The original bill mentions 12 sectors where the U.S. leads in technological innovation but lags in manufacturing, including "advanced energy" and "green manufacturing." According to the bill, "all too often, excessive short-termism precludes companies in the United States from accessing investment capital. It is in the interest of the Federal Government to ensure that patient capital (or capital with an investment horizon of not less than seven years) is available to boost supply chains and to manufacture in the United States."

IFCUS would be government-owned but functionally independent, allowing the organization to select and finance manufacturers based on formally set criteria without political interference. The bill mandates that IFCUS focus on supporting resilient supply chains in critical industries, prioritizing U.S. manufacturing as a driver of economic development and well-paying jobs, and supporting the on-shoring of the commercialization of advanced technologies. It also prioritizes small and medium-sized manufacturers, particularly in industries subject to industrial policy support in competing economies.[33] The lawmakers behind the proposals hope that IFCUS can fix the market failure of the valley of death that has led U.S. taxpayers to fund high-risk technological innovation but prevented them from reaping the benefits in the form of domestic economic outcomes. Like other state-owned investment banks, IFCUS would likely be required to be profitable but yield lower returns than comparable private sector institutions that have not lent to small and medium-sized manufacturers.[34] In doing so, IFCUS would provide 'patient capital.' It could also

accept a rate of return that would allow it to maintain and grow its capital base, but that is too low to be attractive for private financial institutions held to short-term financial targets and quarterly earnings reports.

While the bill currently has an uncertain path to implementation, it nonetheless presents a fundamental departure from existing discourse in Washington that has long lamented the existence of industrial policies in other economies without developing proactive solutions at home.[35] Yet even if implemented, it is clear that the IFCUS proposal would just be a start for several reasons.

First, it is unclear whether the proposed capitalization of $50 billion will be sufficient to revitalize American manufacturing, particularly if stretched across a large number of industrial sectors. Neither the U.S. banking sector nor the domestic venture capital industry has shown sufficient appetite for funding high-tech manufacturing. Hence, IFCUS needs to meet substantial capital needs while competing with China's large state-owned banking sector that has shown considerable willingness to invest in production facilities in critical industrial sectors. In 2010 and 2011 alone, The China Development Bank extended $47 billion in credit to China's largest wind and solar firms, which they were able to leverage as guarantees to procure additional funding from private lenders.[36] Similarly, Germany's state-owned KfW bank is the nation's third-largest bank with half a trillion Euros in assets.

Second, the bill stipulates a focus on small and medium-sized businesses with fewer than 500 employees and requires that IFC investments of more than $10 million be reported to Congress. While it is certain that larger manufacturers have significant capital needs, and currently unclear whether the bill would explicitly preclude

funding for them, past incidents may make Congress view them as high-risk. For example, Solyndra, the infamous solar manufacturer that went bankrupt despite a $500 million government loan guarantee, at some point had more than 1100 employees on the payroll. Thus, in addition to the more significant financing needs of small and medium-sized firms, the political fallout of the Solyndra bankruptcy may be one of the reasons the proposal currently avoids lending to larger firms.

However, reaching the economies of scale needed to compete in global clean energy markets may require extending far larger loans to manufacturers than included in existing proposals. But, as the Solyndra example illustrates, such large loans carry political risk. It is likely inevitable that some loan recipients will not be successful. While political risk makes sticking to the smaller loans for small and medium-sized manufacturers politically prudent, it could mean that setting up IFCUS alone will be insufficient to establish the mass production facilities required to reach scale economies for American-made clean energy technologies.

Finally, it is uncertain whether the American political climate could afford IFCUS the necessary independence to make sound decisions about investing in advanced manufacturing supply chains. For example, although the loan guarantee program that supported Solyndra was overall successful and had low bankruptcy rates, the collapse of the solar manufacturer was quickly exploited for political gain. Yet such bankruptcies are an inevitable part of the commercialization of advanced technologies; IFCUS would likely not be able to avoid them entirely. Moreover, while the IFCUS proposal foresees a political firewall between Washington's partisan politics and the decision-making on loans and investments, the Congressional reporting requirement for investments over $10 million alone provides plenty of fuel

for political fights that may eventually erode any independence foreseen in the proposal.

Conclusion

Historically, the United States has been the largest investor in clean energy research and development and continues to lead in many areas critical for fixing the climate crisis. U.S. companies are at the forefront of developing next-generation technologies that could make decarbonization cheaper and more efficient, including next-generation solar technologies, advanced battery chemistries, new building materials, smart grid technologies, and software to manage complex energy systems.[37]

Addressing grand challenges like climate change will continue to require fundamental advances in technology, where the United States is uniquely equipped to be at the global frontier. But this should not mean simply continuing to support the core strengths of U.S. firms and universities—the invention of new technologies—through investments in basic and applied research. The technologies that emerge from these efforts must eventually be scaled and deployed, and for now, working with foreign manufacturers is often the only option for many domestic firms. Current stresses on global supply chains, especially in light of growing U.S.-China rivalry, point to the risks of this strategy. Investing in domestic manufacturing capabilities could be part of a national strategy for technological innovation.

The creation of an institution like IFCUS could support domestic clean technology manufacturing projects that the U.S. financial system has been unwilling to fund. IFCUS would complement such institutions and be critical to shifting the

global division of labor in clean technology sectors in favor of domestic manufacturing. By creating and maintaining domestic jobs in clean tech manufacturing businesses, it would make it easier politically to pass ambitious climate policies: A government-owned corporation tasked with providing capital to small and medium-sized manufacturing businesses would help increase the number of middle-class manufacturing jobs in clean energy industries and stretch the economic reach of clean energy beyond the service sector jobs that already exist today. Doing so would broaden the political coalitions in support of climate action, in the best-case convincing labor unions, manufacturing businesses, and manufacturing workers that good climate policy can help grow the economy. It could also help reduce dependence on imported clean energy technologies and ensure that public R&D support yields domestic economic results.

It would also likely only be the start, as capital needs will probably exceed what IFCUS could shoulder. Other institutions critical for manufacturing are also in need of repair, including America's system for vocational training. A stable regulatory framework to support domestic markets for clean energy technologies is also needed to improve national competitiveness in clean energy technology sectors. Even then, it is unlikely that entire value chains for complex energy technologies would ever lie entirely within national borders.

Nonetheless, the IFCUS proposal for the first time establishes a domestic response to other countries' industrial policies, which would represent a clear break with Washington's longstanding pattern of simply criticizing those countries' policies. It would directly address the institutional reasons behind America's declining manufacturing sector, particularly in critical industries that receive favorable

government support in other parts of the world. Moreover, as Washington debates the merits of a national climate bank, IFCUS could be a model for and a complement to institutions that address other climate-related financing challenges which require domestic solutions.[38] From municipal infrastructure investments to residential energy efficiency, low-cost, long-term financing will be critical in responding to the climate crisis. Private financial institutions are not ready to meet those needs alone.

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