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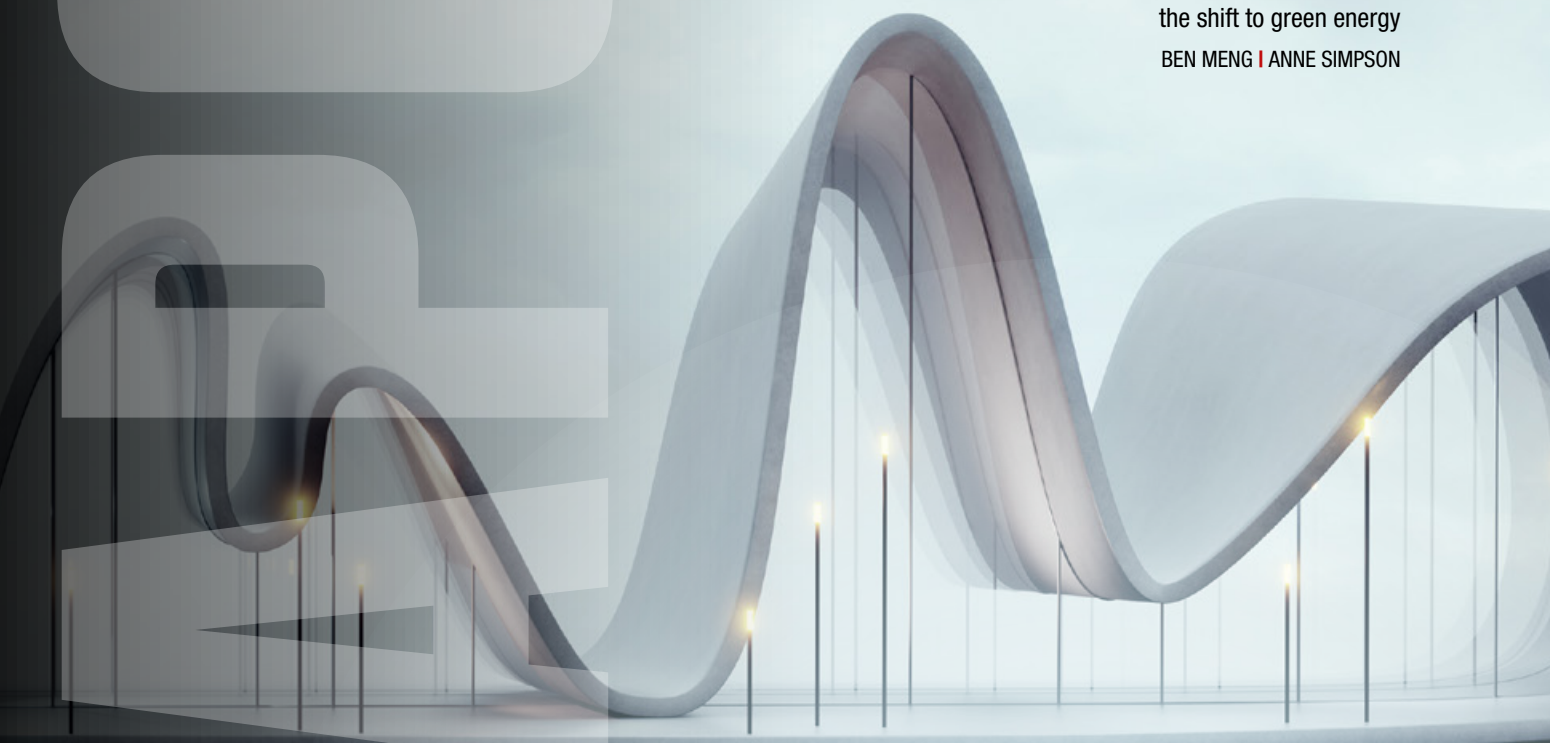
GOVERNANCE OF SUSTAINABILITY

Government incentives accelerating the shift to green energy

BEN MENG | ANNE SIMPSON



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DEAR READER,

In my new role as CEO of Capco, I am very pleased to welcome you to the latest edition of the Capco Journal, titled **Balancing Innovation and Control**.

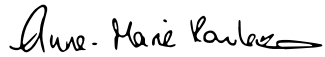
The financial services and energy sectors are poised for another transformative year. At Capco, we recognize that this is a new era where innovation, expertise, adaptability, and speed of execution will be valued as never before.

Success will be determined based on exceptional strategic thinking, and the ability to leverage innovative new technology, including GenAI, while balancing a laser focus on risk and resilience. Leaders across the financial services and energy industries recognize the transformative benefits of strong governance while needing to find the optimal balance between innovation and control.

This edition of the Capco Journal thus examines the critical role of balancing innovation and control in technology, with a particular focus on data, AI, and sustainability, with wider corporate governance considerations. As always, our authors include leading academics, senior financial services executives, and Capco's own subject matter experts.

I hope that you will find the articles in this edition truly thought provoking, and that our contributors' insights prove valuable, as you consider your institution's future approach to managing innovation in a controlled environment.

My thanks and appreciation to our contributors and our readers.



Annie Rowland, **Capco CEO**

GOVERNMENT INCENTIVES ACCELERATING THE SHIFT TO GREEN ENERGY[1]

BEN MENG | Chairman, Asia Pacific, Franklin Templeton
ANNE SIMPSON | Global Head of Sustainability, Franklin Templeton

ABSTRACT

Many government policies – both carrots and sticks – are driving the global transition to greener energy systems. In this article, we compare regulatory sticks, like carbon pricing, with carrots like feed-in tariffs that subsidized solar renewables in countries like Germany. We reviewed carbon pricing across the globe and discuss why higher prices remain challenging to implement politically. We also challenge the view that government subsidies are wasteful and discuss the steps taken by different countries to lower emissions. We conclude with an optimistic outlook of the U.S. government's new industrial policy and note a new record in global investments in low-carbon technologies. That said, governments in China, the E.U., and the U.S. are deploying carrots and sticks at markedly different speeds and intensity. Looking ahead, global security analysts seeking to generate alpha will need to integrate top-down subsidies into bottom-up security analysis to uncover risks and opportunities.

1. INTRODUCTION

Many government policies – both carrots and sticks – are driving the global transition to greener energy systems. In this article, we compare regulatory sticks, like carbon pricing, with carrots like feed-in tariffs that subsidized solar renewables in countries like Germany.

First, we review carbon pricing across the globe. Higher prices remain challenging to implement politically. We explain why some economists fixate on the efficiencies of carbon taxes and dismiss government subsidies as wasteful. We explore China's new carbon market, which aims to lower emissions from China's coal-fired power plants.

Second, we explain how governments like Germany helped kick-start a boom in solar-power innovations by deploying subsidized carrots. One of the biggest catalysts driving down today's solar prices comes from economies of scale in Chinese manufacturing. We review an emerging consensus among economists that subsidies are accelerating a "green vortex" in places like Texas in the U.S.

We conclude with an optimistic outlook of the U.S. government's new industrial policy and note a new record in global investments in low-carbon technologies. That said, governments in China, the E.U., and the U.S. are deploying carrots and sticks at markedly different speeds and intensity. Looking ahead, global security analysts seeking to generate alpha will need to integrate top-down subsidies into bottom-up security analysis to uncover risks and opportunities.

[1] This article draws inspiration from Bose, Dong, and Simpson (2019) and builds on the framework developed by Meng and Simpson (2023).

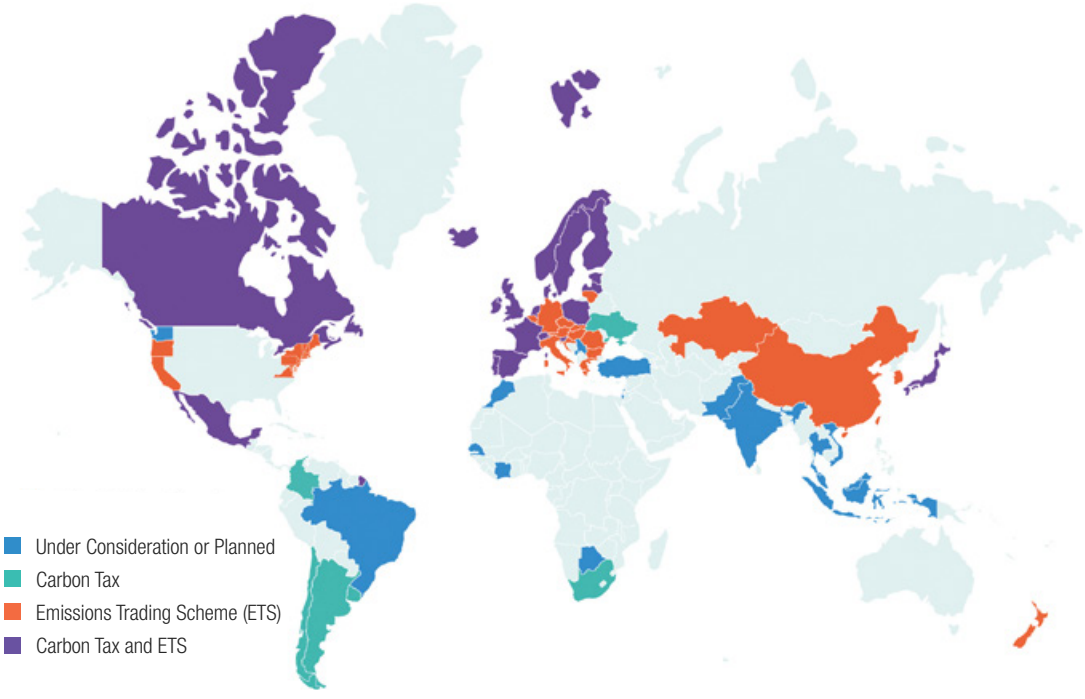
2. CARBON STICKS

For many years, the primary climate policy recommended by many economists was carbon pricing. Compared to government subsidies, carbon price signals offered a more elegant response to the complex problem of CO_2 emissions. Why? In their view, subsidies are often inflexible and inherently prone to wasteful overcapacity. With more countries racing to subsidize home-grown green industries, some warn that vast amounts of public money may go to waste [Economist (2023b)]. Instead of picking winners via government handouts – a "destructive new logic" that forsakes the invisible hand of free-market capitalism for the visible hand of "aggressive industrial policy" – carbon pricing offers a more efficient approach. Unlike subsidies, carbon pricing gives companies the freedom to reduce emissions by whatever means they see fit [Economist (2023c)].

If carbon pricing offers a more efficient road to our zero-carbon future, there is progress to celebrate. Over 46 countries price greenhouse gases – either through carbon taxes, emissions trading systems (ETS), or both – and they together account for 30% of global CO_2 emissions (Figure 1) [Black et al. (2022)]. One notable participant, China, launched the world's largest carbon markets in 2021, covering one-seventh of global CO_2 emissions, and three times larger than the E.U.'s ETS [Busch (2022)]. Currently, China's nation-wide ETS regulates roughly 2,162 companies from the country's power generation sector, which emit 4.5 billion tons of CO_2 annually [Xue (2022)]. Given China is the world's largest carbon emitter, we think this is a critical step in that country's drive to reach zero carbon by 2060.

> *"Today's green vortex represents a handshake between the visible hand of government policies, which kick-start innovation with early funding, and the invisible hand of free-market capitalism, which efficiently directs capital to climate solutions."*

Figure 1: Countries choose different approaches to pricing carbon (as of August 2023)



Sources: World Bank Group (WBG), International Monetary Fund (IMF), and national sources.
Note: The boundaries and other information shown on any maps do not imply on the part of IMF any judgment on the legal status of any territory or any endorsement or acceptance of such boundaries.

At this early stage, China's ETS is mainly structured to incentivize improvements at its coal-fired power plants by squeezing out inefficiencies and reducing carbon intensity [Mazzocco (2021b)]. China's government initially planned to also include other high-carbon industrial sectors, such as cement and aluminum in 2022, but saw delays due to data quality. China's Ministry of Ecology and Environment, for example, found compliance verification issues with most of the power sector company data [Tan (2022)]. By 2025, China aims to include even more carbon-emitting sectors, such as oil refining, chemicals, building materials, and non-ferrous metals. Looking ahead, India plans to launch its own national carbon market in 2026. Like China, India's stakeholders will target high-carbon sectors such as power generation alongside a range of industrials like steel and cement [Choudhary and Macquarie (2023)]. Details of this cap-and-trade market – similar to the E.U.'s ETS – are still being worked out. For example, it is unclear how India's existing voluntary carbon market will fit into the new trading scheme. That said, many of India's stakeholders understand that carbon price signals need to be high enough that cutting emissions will be rewarded. To that end, India's government plans to deploy a price stabilization mechanism to better incentivize low-carbon solutions [Singh and Narayan (2022)].

The framework for India's pricing mechanism comes from the E.U., which added a carbon "market stability reserve" to its ETS in 2019. Just months after launching, E.U. carbon prices reached levels not seen in a decade [IEA (2020)]. Why? The supply of allowances had outstripped demand, causing a surplus. That meant carbon price signals were too low to incentivize economic changes. By tapping its reserve portfolio to buy carbon allowances, the E.U. has boosted carbon pricing to over U.S.$100 per metric ton in 2022. As we discuss below, in the absence of stronger price signals, free markets can have difficulty reshaping economic activities.

Table 1: Carbon pricing via carbon taxes, emissions trading systems, or both

Carbon taxes have a practical appeal by providing certainty over future emission prices that encourage green investments. These taxes also generate revenues that governments can use to tackle debt, ensure a more "just transition" by redirecting revenue to the poor and make green investments.	**Emissions trading systems** directly target emission levels by issuing carbon allowances that companies are required to obtain. By trading these allowances, the free market establishes carbon prices. It is not a fixed tax. Countries like France deploy fixed carbon taxes alongside the E.U.'s ETS.

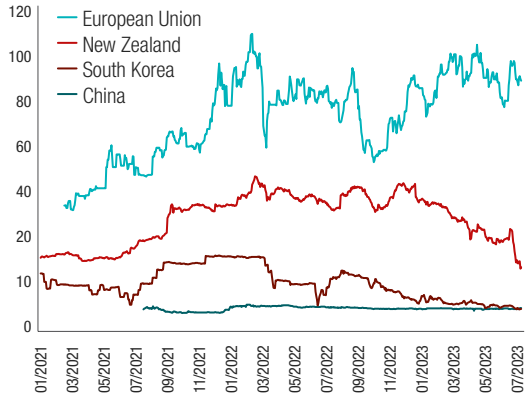
2.1 No pain, no gain

Since 2013, California's ETS has had a clear mission. By setting limits for 85% of California's CO_2 emissions, state authorities have established "a price signal needed to drive long-term investment in cleaner fuels and more efficient use of energy" [CARB (2015)]. In retrospect, however, a growing cohort of economists now admit these prices have not been tough enough to force much change on their own.

To be clear, California's electric utilities have slashed emissions by 36% from 2013 through 2019 – but that was mainly due to state laws forcing utilities to incorporate more renewable power [Baker (2022)]. This critique is not unique to California. Back in 2012, economists reached the same conclusion when assessing Europe's ETS. They found that the program had quite limited effects on the rate and direction of corporate clean-energy innovations [Schmidt et al. (2012)]. Thanks to the new price stability mechanism, however, the E.U.'s carbon price signals are exponentially higher today (Figure 2).

Two questions arise when looking at the global carbon-pricing map in Figure 1. First, how high are carbon prices today? Globally, the IMF estimates U.S.$20 per ton on average across regions with price signals. Across all CO_2 emissions globally, however, it drops to U.S.$5 per ton [Parry et al. (2022)]. In regions with price signals, only 10% have carbon prices at U.S.$65 per ton or higher [OECD (2021)].

Figure 2: Emissions trading systems in the E.U., New Zealand, South Korea, and China (U.S.$/metric ton CO_2 equivalent)



Source: Bloomberg (as of July 6, 2023)
Note: Index currencies converted to U.S.$. Korean Allowance Unit 2022: Listing on 1/4/2021 and delisting on 8/11/2023.

Second, how high should carbon price signals be? This depends on specific future goals: such as reaching net zero by 2050, calculating future carbon sequestration costs, or measuring the social costs of carbon (SCC) that each ton of carbon inflicts on humans. In 2013, an interagency working group within the U.S. government estimated that the SCC were U.S.$36 per ton [Shelanski and Obstfeld (2015)]. Nine years later, new climate analysis by the U.S. Environmental Protection Agency raised the SCC to U.S.$190 per ton [Lithgow (2022)]. This dovetails with 2022 economic research by Resources for the Future – a climate and energy think tank – that finds each additional ton of carbon emissions costs society U.S.$185 [Rennert et al. (2022)].

It is worth noting here that the U.S. does not have a national ETS, nor do many other countries. Indeed, less than 30% of global CO_2 emissions are covered by carbon pricing schemes [IEA (2022)]. Out of this slice, the vast majority of today's CO_2 trading volume comes from just two carbon markets in the E.U. and China. Recent efforts to convince U.S. corporate CEOs and U.S. lawmakers to launch a similar ETS has come from the Commodity Futures Trading Commission (CFTC) [CFTC (2020)]. In testimony before the U.S. Senate in 2021, Bob Litterman, CFTC Climate-Related Market Risk Subcommittee of the Market Risk Advisory Committee Chairman, explained that without a national ETS, all manner of U.S. financial instruments – stocks, bonds, futures, bank loans – face painful and disorderly adjustments down the road [Litterman (2021)].

The CFTC's core message reflects the growing certainty that, outside the E.U., average carbon prices are simply too low to redirect capital at the scale and speed needed. Case in point, China's price is just U.S.$8 per ton of CO_2, far below the E.U. (Figure 2). That said, we are less concerned for two reasons.

First, China's carbon pricing will reduce the carbon intensity of its coal-fired plants in the near term, before scaling up in the future. Second, the E.U. plans to implement a carbon border tax that will have positive ripple effects across the globe. Countries that trade regularly with the E.U. can either forfeit money at the border when selling high-carbon products or invest more at home in clean-energy systems to avoid the tax. We think the E.U.'s carbon stick will help incentivize trading partners to transition their economies quickly.

Indeed, in his Senate testimony, Litterman (2021) noted that the U.S. economy is 300% more carbon-efficient than competitors like China, Russia, and India. A carbon border adjustment would raise new revenues for the U.S. government. From Litterman's vantage, he said it was remarkable that leaders from both Republican and Democratic administrations have come together in support of a market mechanism that asks non-domestic manufacturers to compete based on carbon efficiency. "But given the win-win outcomes, it should not be surprising," he said.

2.2 Measuring carbon leakage

It is important to note that the E.U.'s carbon border adjustment mechanism (CBAM) remains a work in progress. For starters, the E.U. is initially targeting sectors it believes have the most significant risk of carbon leakage [E.C. (2023)]. That means high-carbon industrials, like iron and steel, aluminum, cement, fertilizers, as well as electricity and hydrogen. Many of these sectors, like cement, pose significant engineering and technology challenges, as we highlighted in 2021 [Khatoun et

Box 1: Spillover effects of a carbon border tax

By design, carbon border taxes are meant to have a global impact. But what about the spillover effects on emerging economies? Because many countries have either quite low or no carbon prices, some security analysts think companies outside the E.U. will simply shift their exports, like steel and fertilizer, to other non-E.U. countries and not bother decarbonizing [Sharma (2022)]. One think tank has modeled the cost increases that future E.U. carbon tariffs will have on iron and steel imported into the E.U. from China, Brazil, Russia, and India. Prices for India's steel could rise 15% in the E.U.; prices for steel from China, Brazil, and Russia could rise 3-4% [Xiaobei et al. (2022)]. The authors, however, note the macroeconomic impact of the border tax on these countries looks modest. For example, the effect on China's GDP is negligible – these exports into the E.U. are just 0.4% of China's overall exports – while Russia's GDP could drop 0.2% by 2030. Bear in mind, this economic analysis was published mere weeks after Russia's invasion of Ukraine.

al. (2021)]. Europe is deploying billions of capital in early-stage demonstration projects, testing green hydrogen and carbon capture solutions at steel and cement factories across Europe.

From now through the end of 2025, there will be no carbon tax at the E.U.'s borders. Instead, the focus will be on ironing out the methodology for accurately measuring the "Scope 1 emissions" embedded in these industrial goods. Scope 1 refers to direct CO_2 emissions during the production process. If nothing else, establishing the right methodologies to measure carbon, which is also verifiable globally, will be an enormous step forward.

These new methods are necessary to measure carbon leakage, which can happen in two ways. First, E.U. businesses could relocate industrial production to countries outside the E.U. with lower or no carbon prices. Second, carbon leakage can occur if products made in the E.U., like steel or cement, are replaced by equivalent imports with higher CO_2 intensity at cheaper prices.

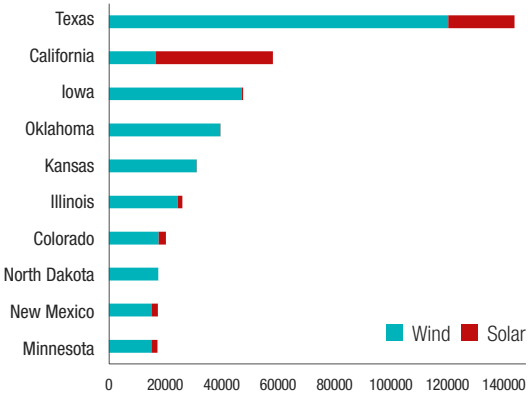
For security analysts, it is clear that E.U. carbon pricing brings headwinds to Europe's industrial companies. The cost of retrofitting plants with carbon capture, for example, are eating into profits and may boost prices higher than most non-E.U. competitors. Indeed, the "buy or sell" recommendations of Europe's largest cement makers were downgraded in 2020 for this exact reason [Dempsey (2020)]. Analysts rightly argued that higher cement prices would expose E.U. companies to carbon leakage via cheaper imports from India's cement industry [Investec (2020)]. At the time, we noted a carbon border tax would likely resolve this issue. We stand by our analysis and think the macroeconomic impact on emerging economies will be modest – see our discussion on "spillover effects" in Box 1. We think Europe's border tax will lead the way to a faster energy transition across developed and emerging economies alike.

2.3 The green vortex

As we have discussed, carbon pricing has dominated conversations around climate policy for decades. Today, it still features prominently in academic circles and publications like The Economist. A growing number of scientists, however, now recognize that carbon sticks are not the only option. And they have clear evidence to prove it. Consider California's carbon market, which some climate analysts consider to be one of the best-designed carbon programs in the world [Hiltzik (2018)]. If that is true, how do we explain power generation in the state of Texas?

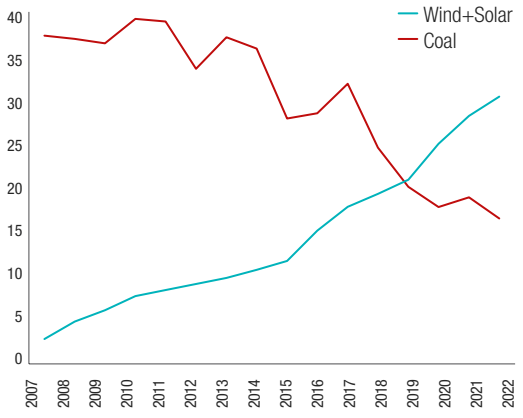
Figure 3: Texas' green vortex

3A: TOP TEN U.S. STATE WIND AND SOLAR LEADERS (ANNUAL)



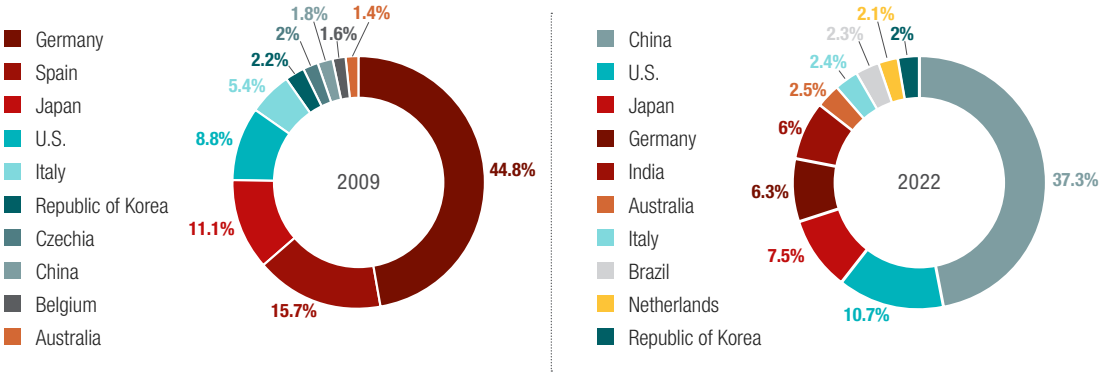
Source: U.S. Energy Information Agency (EIA)
Net generation in thousand megawatthours as of 2022

3B: TEXAS WIND + SOLAR AND COAL GENERATION (AS %)



Source: Electric Reliability Council of Texas (ERCOT)

Figure 4: : Top ten countries by share of installed solar capacity (%)



Source: International Renewable Energy Agency (IRENA)

In the first quarter of 2022, Texas led the U.S. in renewable energy, accounting for over 14% of U.S. green-energy production [Gilligan (2022)]. Many Texans bristle at government taxes – the state does not levy a state income tax – and are proud of the state's fossil-fuel industries. And yet, Texas now produces nearly twice as much electricity from renewables as from coal (Figure 3).

Texas is clearly decarbonizing. But why? Some climate analysts call this process a "green vortex" [Meyer (2021)]. The phrase describes the accelerating combo of technological advances and the appeal of green profits that were kickstarted by – wait for it – government subsidies. Today, we are seeing a newfound appreciation for industrial policy among economists, though certainly not all [Meckling (2021)]. This represents a qualitative shift away from classic climate policy that mainly focused on carbon pricing.

In our view, today's green vortex represents a handshake between the visible hand of government policies, which kick-start innovation with early funding, and the invisible hand of free-market capitalism, which efficiently directs capital to climate solutions. All combined, the return premium from green climate solutions – a return "greenium" – is something we discuss in an upcoming paper in the Journal of Investment Management.

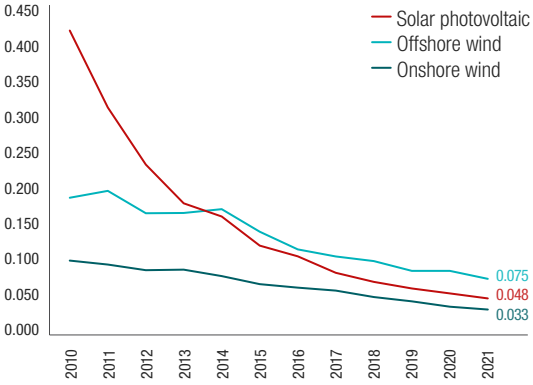
To unpack this worldview, we turn next to advancements in solar photovoltaic production in recent decades, which benefited from a wide range of government carrots such as loan guarantees and feed-in tariffs. Rather than imposing upfront costs on existing fossil-fuel assets, some policy analysts now argue clean-energy subsidies should precede phased-in taxes, to better redirect "private investment away from polluting capital and towards clean capital" [Rozenberg et al. (2020)].

3. SUBSIDIZED CARROTS

In October 2022, at the opening of the Chinese Communist Party's 20th National Congress, President Xi Jinping spoke at considerable length about safeguarding the environment by accelerating China's clean-energy revolution. To reach carbon neutrality by 2060, Xi reiterated the principle of "establishing the new before destroying the old" [Yin and Yep (2022)]. This phrase means building a reliable, renewables-centered economy first through government subsidies, before eliminating the use of fossil fuels like coal.

Xi's philosophy is not unique to China. Researchers at the think tank MacroPolo remind us that advanced economies, chiefly Japan and Germany, deployed government loans and capital in the 1990s to help jump-start their fledgling solar industries. For example, Japan launched a solar rooftop subsidy program in 1994, helping drive down costs of solar installations by more than 65% over the following decade [Mazzocco (2021a)].

Figure 5: World's levelized cost of renewable electricity (in U.S.$/KWh)



Sources: Our World in Data, IRENA

Across Europe, but particularly in Germany, government feed-in tariffs were deployed as either a primary or exclusive policy mechanism to drive solar energy deployment through the 1990s and 2000s. Feed-in tariffs are government incentives that guarantee a certain level of financial benefit for each unit of electricity produced by renewables, like solar panels. These fixed-price contracts – which typically last 10 to 20 years – sent a clear price signal to developers and utilities across Europe that installing solar panels would be profitable [Couture et al. (2010)]. By substantially increasing these solar subsidies in 2000 and 2004, Germany saw an explosion of solar installations through the 2000s (Figure 4).

3.2 Green industrial policies

Around this same time, China was busy incentivizing solar panel manufacturing in rapidly urbanizing cities like Wuxi. China's manufacturers received access to subsidized land and modern manufacturing infrastructure, along with special financing and tax cuts. The goal was to accelerate growth in polysilicon manufacturing and wafer production, creating vertically integrated supply chains. The economist, Paul Krugman, calls this phenomenon, in which supplies of key materials, like polysilicon, are situated near the production of solar photovoltaic (PV) cells, modules, and panels, "agglomeration."

All combined, China's industrial carrots helped scale up solar PV production 500 times from 2000 to 2016 [Mazzocco (2021a)]. Why is scale important? Economists studying the mechanics of technological innovations find that economies of scale and learning-by-doing play an outsize role in lowering costs and improving quality across clean-energy technologies [Nagy et al. (2013)]. This economic theory – known as Moore's Law and, in a slightly modified version, called Wright's Law – was recently tested against historical data and held up quite well [Santa Fe Institute (2013)].

It is these economic laws – and the government incentives that drove them – that help to explain a seismic shift in competitiveness of renewable electricity over fossil fuel options. From 2010 to 2021, the costs of solar PV electricity dropped 88%, which is now below the costs of fossil fuel electricity (Figure 5) [IRENA (2022)]. At these prices, solar PV is now more profitable for power plants than coal- or gas-fired electricity.

This breakthrough in clean-energy pricing brings us back to the concept of the "green vortex" that we discussed earlier. In India, the outlines of a national carbon market are just emerging. And yet, it is with an eye toward green profits that India's largest power company is now committed to building 60 gigawatts of solar PV electricity by 2032 [Bullard (2021)]. Why? The power from newly built solar capacity in India is now cheaper than the power from existing Indian gas- and coal-fired power plants. It is really that simple. Indeed, India's government now plans to stop building new coal-fired power plants by removing a key clause from the final draft of its National Electricity Policy [Singh and Varadhan (2023)]. Cheaper renewables means India does not need new coal additions, apart from what is already in the near-term pipeline.

3.3 Leading with carrots

For investors worried that industrial policies may usher in the demise of free-market principles championed by Adam Smith, we highly recommend a economic paper from the Boston Review [Stokes and Mildenberger (2020)]. The authors have assembled a wide array of new research from economists who suggest government incentives – both industrial policy carrots and carbon pricing sticks – are indispensable to reaching our clean-energy future.

As for green-energy carrots overturning free-market orthodoxy, BloombergNEF (2021) notes that G20 governments handed out U.S.$3.3 trillion of direct fossil-fuel subsidies from 2015 through 2019. These direct subsidies, however, do not include the mountain of implicit subsidies from governments that do not currently impose national carbon prices. The IMF recently calculated that governments showered companies with U.S.$5.9 trillion of implicit fossil fuel subsidies in 2020 alone [Parry et al. (2021)]. If governments can hand out "carbon carrots" to oil and gas companies by avoiding an E.U.-style ETS, then subsidizing green-energy innovations should not scramble free markets, in our view.

As for solely focusing on carbon sticks to incentivize the energy transition, that approach can deliver short-term pain, like higher energy bills, while concealing longer-term gains for the environment, public health, and most economies. In our view, it is better to lead with government carrots that accelerate the arrival of cheaper green energy and well-paying jobs before phasing in higher carbon prices. In other words, we should build the new before destroying the old. This carrot approach has finally arrived in the U.S., first with infrastructure legislation in 2021, earmarking billions for a clean-energy grid and charging stations for electric vehicles (EVs) [Newburger (2021)], and then with the Inflation Reduction Act (IRA) of 2022. The IRA offers U.S.$369 billion in subsidies to jump-start clean-energy innovations while on-shoring green manufacturing [Hanwha (2022)].

These subsidies might be jarring to some security analysts. Some will point to Solyndra, a solar PV start-up that received a U.S.$535 million loan guarantee from the U.S. government in 2009. In their view, Solyndra's bankruptcy in 2011 is proof that government carrots are inherently wasteful. We note that Tesla received a similar loan for U.S.$465 million in 2010 – part of the same program to accelerate U.S. clean-energy technologies – allowing it to expand its production facility [Bose et al. (2019)]. Was that loan also wasteful?

To understand how our security analysts scrutinize the impact of government carrots on capital markets and individual companies, we suggest reading an interview with our Shanghai-based investment team. They explain how integrating policies like "Made in China 2025" into equity and credit analysis helps uncover risks and opportunities that many investors might otherwise miss [Xu et al. (2021)].

4. CONCLUSION

If there is some handwringing over U.S. President Joe Biden's new industrial policies, The Economist notes that history offers some reasons for optimism. For example, in the aftermath of the Second World War, scores of governments unleashed industrial carrots to supercharge industrialization, with great success in places like Japan and South Korea [Economist (2023a)]. Today, the Biden administration is deploying similar incentives, like green-energy procurement contracts that will accelerate demand for 100 gigawatts of solar power systems over the next decade. That is nearly as much as the U.S.'s installed solar-power capacity today. It is an economic approach that harkens back to policies the U.S. deployed to land astronauts on the moon.

Responding to the U.S., the E.U. unveiled its own green industrial strategy in March 2023. While it does not offer new funding, the plan aims to simplify the thicket of E.U. regulatory hurdles, streamlining the approval of national green-finance tools already available in Brussels [Economist (2023d)]. A major goal of building green industries inside the E.U. is reducing dependence on energy imports, a security lesson learned from Russia's war in Ukraine. The E.U. recognizes that China dominates global manufacturing across key net-zero technologies, including electric vehicle batteries, solar panels, and wind turbines [Campbell and Gritz (2023)].

So, what impact will these E.U. and U.S. industrial policies have? Over the long term, we see these programs expediting the push of green technologies forward, with competition between the world's three largest economies – the U.S., China, and the E.U. – reducing the costs of green technologies even faster [Conley (2023)]. Looking ahead, we believe the ability of investment analysts to produce alpha will increasingly hinge on analyzing how government carrots and sticks are accelerating both opportunities and risks across private and public investments.

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