How Narratives Drive Solar Energy Adoption and Innovation

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This paper explores the ways in which four dominant narratives have influenced the solar energy industry through the lens of narrative economics. The diffusion of solar energy has not only been driven by technology and policy, but also by powerful narratives that shape the way people think about energy and its connection to the environment and the economy. Using narrative analysis, this paper analyzes four key narratives: The Technological Advancement Narrative, The Local Industry Development Narrative, The Common Enemy Narrative, and The World is Ending Narrative. These narratives stood out due to their reach and impact on public behavior and economic decisions, and this paper discusses how they have developed and shaped public opinion internationally. This paper demonstrates narratives' effectiveness in the energy market. Understanding how they work can help policymakers, corporate leaders, and climate activists make better decisions and build strategies to ramp up renewable energy. However, these narratives have also driven countries to implement systems such as FITs, which have led to fluctuations in solar PV development.

Introduction

In recent years, the severity of climate change has grown at an exponential rate. According to a NASA study, atmospheric carbon dioxide levels have increased by 50% since the industrial times in the 18th century[1]. As a result, renewable energy and climate change have been emerging problems worldwide.

This paper outlines the profound impacts that four major narratives have on solar energy entrepreneurship in the solar sector through the lens of narrative economics. I call these narratives the "Technological Advancement Narrative," the "Local Industry Development Narrative," the "Common Enemy Narrative," and the "World is Ending Narrative." Throughout the paper, several countries, including the United States, Spain, Germany, and Slovakia, are analyzed in varying depth and across different time periods. This paper aims to trace the four narratives over the periods of most importance, resulting in varying levels of analysis.

Since solar energy became popular in the 1980's four main narratives have helped spread solar energy across the globe. First, fossil fuels and climate change served as a common enemy for many social activists, and solar energy became popular because it was a universally agreed-upon solution (Koopmans & Duyvendak, 2014; Pew Research Center, 2023)[2,3]. National policies such as imposing tariffs were ways in which countries such as the U.S. could gather nationwide support for solar energy, while events such as the Paris Climate Agreement set global goals for greenhouse emissions that united countries worldwide (EPA, 2017)[4]. Next, the narrative that the world is ending has been the backbone of solar energy support since the founding of the movement. The idea that the environment is getting destroyed by fossil fuels and unstable energy production is spread by environmental activists and science organizations, resulting in a greater focus on sustainability and the preservation of the environment. Additionally, the narrative around the solar industry building an industry that creates jobs and improves local economies is one being spread by the government as well as job seekers (SEIA, 2024; Republic of Solar, 2024)[5,6].

This narrative builds on the previous two, as it is not only built around the incentive of bettering the environment but also focuses on becoming a leader in an emerging market. Finally, the narrative that solar energy is a more technologically advanced means of energy production is backed by solar companies and the supporters of FITs. With lower costs and more efficient production, solar energy is described as a futuristic alternative to its environmentally harmful and unsustainable counterparts.

It is important to consider these narratives because the majority of the public whose decisions impact economic events are not well-informed. However, their decisions greatly influence economic activity, so attention-grabbing narratives must ultimately affect their decisions. It is therefore crucial to understand the narratives within an industry to evaluate economic results, rather than just focusing on quantitative statistics. The narrative analysis throughout the paper uses archival analysis of secondary data (which may limit the depth of insight and analysis), along with Shiller's approach, which involves taking a historical approach to narratives. He analyzes the spread and impact of economic narratives throughout history, and this paper takes a similar approach: using narrative economics to analyze countries whose solar growth was influenced by narratives.

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Literature Review

This paper uses narrative economics as a framework to analyze the ways key narratives influence entrepreneurship within the field of renewable solar energy (Shiller, 2019)[7].

However, this approach is not solely reliant on Shiller's work. It is also based on other literature and policy studies in the field of narrative economics. For instance, Shiller acknowledges the fundamental concept of human intentionality, as noted by Nobel laureate Douglass North and MacMullen's conviction in his 2005 book, Understanding the Process of Economic Change (Shiller, 2019)[7].

Additionally, in Part II of his book, particularly Chapter 7, Shiller discusses that the framework he uses is not exclusively his, but rather builds on past research. For example, Shiller acknowledges that causality between narratives and economic action is two way and that new narratives can be considered causative innovators, a concept related to the "cultural entrepreneur" of economic historian Joel Mokyr (Shiller, 2019). Shiller also references the work of economists David Cass and Karl Shell on "subspots" as self-fulfilling prophecies generated by narrative mutations (Shiller, 2019; Cass and Shell, 1983)[7,8].

Ultimately, throughout his book, Shiller grounds narrative economics in evidence from outside economists and literature. So, while this paper analyzes narrative economics using Shiller's book and approach, his work is based on past research and literature by a variety of economists.

Although stories and narratives are often viewed as similar, a narrative goes a step beyond a story. A narrative is a specific type of story, and as defined in the Merriam-Webster dictionary, a narrative is "a way of presenting or understanding a situation or series of events that reflects and promotes a particular point of view or set of values." Narratives focus on overarching themes instead of specific events, and as a result, have a greater impact on economic fluctuations. Typically, narratives "remind people of facts they might have forgotten, offer an explanation about how things work in the economy, and affect how people think about the justification or purpose of economic actions." Thus, compelling narratives often become viral, and their wide reach can have impacts on the economy that are often overlooked.

In the context of renewable energy, established and emerging businesses leverage the notion that the world will be destroyed by fossil fuels and climate change (Shiller, 2019)[7]. This narrative is discussed around the world, and companies are able to increase profits by branding around the narratives.

A key aspect of narrative economics is the contagion and recovery rates (Shiller, 2019)[7]. As Shiller defines it, "the contagion rate is the average number of people to whom one person tells the narrative per unit of time."The contagion rate shows how easily a particular narrative spreads, while the fade rate describes how long a narrative stays relevant. Narratives with a high contagion rate and low recovery rate are most impactful, as they spread rapidly while remaining relevant for extended periods. Although oftentimes narratives go viral at random, word-of-mouth contagion and the efforts that people make to generate new contagious stories drastically affect the contagion rate of narratives. Contagion is strongest when people can make personal connections to the root of the narrative, and because of climate change's global reach, narratives surrounding solar energy have been spreading rapidly.

In addition, in his book Narrative Economics, Robert Shiller states that "narrative economics demonstrates how popular stories change through time to affect economic outcomes" (Shiller, 2019)7. Because solar energy is becoming increasingly relevant, existing narratives are mutating and new narratives are constantly emerging. As a result, the solar market has evolved to address popular narratives. Furthermore, countries as well as large corporations are also forced to transition to solar energy, as they do not want to be left behind or viewed as detrimental to the environment.

Ultimately, this paper focuses on narrative economics in order to capture a critical influence that drives the solar industry today: how public opinion impacts economic trends and entrepreneurship in the solar sector.

Narrative Analysis

Technological Advancement Narrative

Recently, many US initiatives focused on cost reduction and job creation in the solar industry have supported the narratives surrounding the technological advantages of solar energy (Kennedy & Pew Research Center, 2023)[9]. Over the past few decades, the US government has pushed to cut taxes and costs for installing solar panels nationwide. New federal policies such as the Inflation Reduction Act in 2022, passed by the Biden administration in an attempt to make domestic solar panel manufacturing more economically viable, have influenced the creation of hundreds of clean energy projects, 82 of them solar. As a result, there was a nearly 177% spike in solar panel installations from 2022 to 2023 (Figure 2). In addition, a Boston Consulting Group report "estimated that the IRA's solar provisions could make U.S. modules 25-40 percent cheaper than imports" (Assessing the United States' Solar Power Play, 2024)[5].

These new policies and the recent surge in solar energy initiatives have been driven by a shift in public opinion towards renewable energy. During the early 2000s, solar companies and supporters of FITs jumped on the idea that solar panels are economically better than fossil fuels, causing governments to support the view that a strong national solar industry would make them more technologically advanced.

The economic narrative that solar panels are more advanced than fossil fuels has become increasingly relevant, as countries continue to adopt these values. As a result, the narrative has

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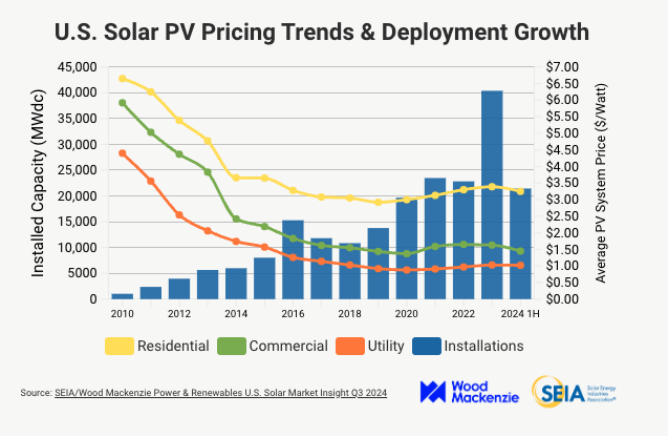

Fig. 2 U.S. Solar PV Pricing Trends & Deployment Growth [10]

built-in credibility, leading to a high diffusion rate, and the lack of strong counter-narratives has allowed the narrative's impacts to continue for decades.

In addition, technological advancement has become increasingly relevant in other industries, showing success and boosting economic growth. As a result, the energy sector has begun to develop as well, and more technologically advanced energy production methods, such as solar energy, have begun to dominate the market in recent years. The narrative that solar energy is the future of energy production has allowed the market to transform from a small niche to a major energy source around the world.

Furthermore, the investment in solar PV was primarily fueled by the narrative that fossil fuels were unsustainable and actively destroying the world. The growing adoption of solar PV has been driven by this narrative of innovation, sustainability, and progress, and has ultimately led to growing investment in the solar market and has influenced key policy decisions that have benefited the market.

The Inflation Reduction Act also addresses the fact that climate change can increase the severity and spread of wildfires. The Act includes $2.15 billion for fuel reduction and land restoration, with a particular focus on the protection of forests from wildfires (Woodwell Climate Research Center, 2022)[11]. Although it is not the act's main focus, the emphasis on forestry in a renewable energy bill illustrates the desire to protect the environment from climate change as a key problem. The act's effects are reflected in the increase in annual additions of renewable energy. Specifically, there was an average 11% increase in annual additions of solar energy over the past two years since the law was passed, compared to a nearly 3.5% average yearly increase over the 12 years since 2010 (SEIA, 2024)[5].

In addition to the IRA, the US Federal Investment Tax Credit Extension in 2008 serves as another financial incentive for homeowners and business owners to install solar panels (Novogradac, 2024)[9]. Those who purchase solar panels directly with cash or using a loan receive a credit worth 30% of the total project costs, which is granted as a tax credit (Novogradac, 2024)[9]. This tax incentive contributed to the steady increase in both residential and commercial solar installations since the extension was passed (Figure 2).

Furthermore, Solar installation rates, especially in the Utility sector, have seen massive growth since 2010 (Figure 1). Specifically, there are now over "210 gigawatts of solar capacity installed nationwide, enough to power 36 million homes" (SEIA, 2024)[5]. One major factor contributing to the increased installation rates is the lower installation and storage costs. For example, the Sunshot Initiative enacted in 2011 aimed to cut costs by 75% by 2020 (Our World in Data, n.d.)14. This initiative, coupled with various tariffs on imported (specifically Chinese) solar panels, showcases the government's goal of becoming a leader in the solar industry, as reduced cost and increased national production allow for the US to break away from its reliance on imported solar material.

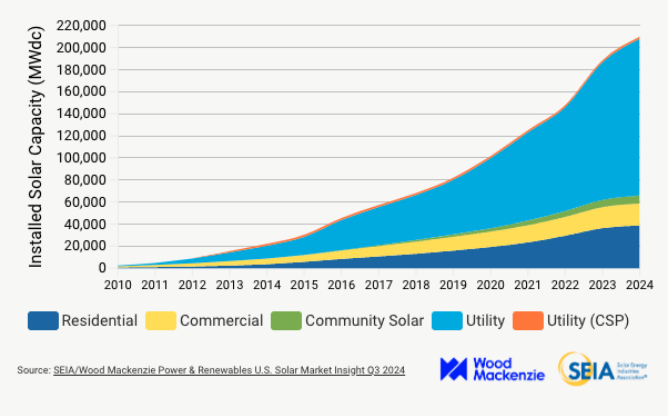

Fig. 1 Cumulative U.S. Solar Installations (Solar Industry Research Data, 2024)[12]

Through the lens of narrative economics, the increased adoption of solar energy in these areas is a result of narrative confluence. The narratives around climate change, renewable energy, and most importantly, technological advancement, aligned to create a powerful story that greatly influenced public opinion and helped build the solar industry.

The combination of these acts has caused the costs of solar to fall by 70% since 2020, and Lithium-ion battery pack prices to drop by 88% between 2010 and 2021, nearly reaching the Sunshot Initiative goal of 75% SEIA (2024)[13].

In addition, the cost of solar storage using lithium-ion battery packs dropped by 88% between 2010 and 2021. However, solar energy is not only becoming popular in the United States. The International Energy Agency reported that in 2023, "407-446 gigawatts direct current of photovoltaics was installed globally," with China leading the market (Zhou, 2024)[14].

Globally, renewable energy accounts for roughly 30% of total

electricity generated (Our World in Data, n.d.)[13]. Specifically, 5% of energy came from solar energy in 2023, compared to less than 0.0% in 2000 (Figure 3). This data shows that in the early days of solar energy, the technological narrative that supported it was just emerging, creating a lower bar for its forgetting rate. However, as the narrative continued to develop and public awareness around climate change grew, environmentalists and renewable energy activists began supporting solar energy. As a result, the contagion rate around solar PV increased over time, as evidenced by the sharp spike in solar energy usage globally.

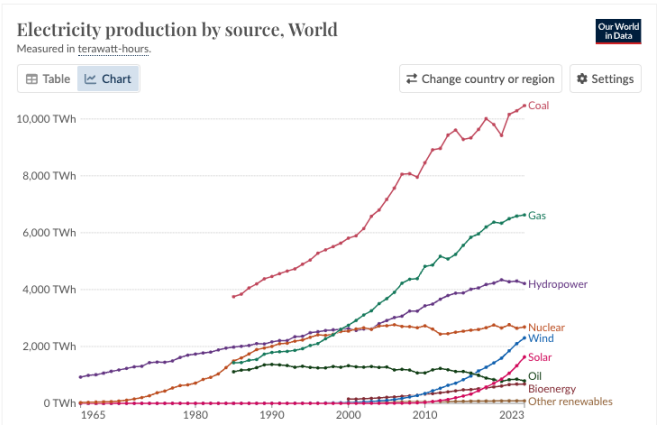

Fig. 3 Electricity Production by Source, World (Electricity Generation From Solar Power, 2024)[13]

Although fossil fuels (mostly oil, coal, and natural gas) still dominate global energy production, the growing worldwide movement for solar energy indicates the impact the narratives surrounding solar energy have.

The high contagion rate, coupled with the low recovery rate, has allowed this narrative to be prevalent for decades. In a time where technological innovation in other sectors such as the internet and artificial intelligence has driven the economy, the narrative around solar energy remains particularly relevant.

What makes the Technological Advancement Narrative contagious is that it is grounded in the idea that solar energy is a futuristic alternative to traditional energy sources. Although the government initiatives and drops in lithium-ion battery prices can not be entirely attributed to narratives, they serve as memorable metrics that keep technological advancement at the forefront of people's minds.

Additionally, major breakthroughs such as the development of photovoltaic (PV) efficiency and advancements in solar panel materials have contributed to the increased efficiency and performance of solar panels (SEIA, 2024; NREL, n.d.-c)[13,15]. Emerging businesses and entrepreneurs are able to leverage the lower price points and increased efficiency to provide benefits to homeowners and corporations, all while preserving the environment. The growing industry has incentivized entrepreneurs to invest in US-based solar, as lower manufacturing costs have allowed US solar production to be more globally competitive.

The technological advancement narrative has helped drive global solar success and, ultimately, has enabled entrepreneurial opportunities that continue to attract interest globally.

A specific example of the narrative's effects was in Spain. The full analysis of Spain's solar industry will be discussed later in this paper, but essentially, there was an initial surge in solar development in Spain, followed by a sharp decline. The decline was triggered by the unsustainable FITs and policies implemented by the Spanish government that initially spurred solar PV growth. However, regional developers in Spain argued for public patience surrounding these policies, as if the country did not have the time to build the capabilities around solar panels, they would fall behind. In other words, the Spanish government used the technological advancement narrative to claim that the benefits of innovation were worth the potential consequences.

Local Industry Development Narrative

In addition to technological advancements, job seekers and governments have emphasized the role of solar energy in driving local industry development. Specifically, the narrative was based on positioning countries as leaders in an emerging industry.

This narrative was particularly promoted by job seekers and governments, with the incentive of not only saving the environment but also being at the forefront of an emerging industry. The fear of falling behind encouraged countries to invest heavily in solar energy, and this international appeal helped create a massive job market almost from scratch.

Although fossil fuel companies began losing labor, raising concerns that the job market might shrink due to competing wages, the narrative influence on government caused officials to support solar and renewable energy. The low forgetting rates for the narrative are due to constant growth in the sector. Additionally, the increased funding for FITs as a result of the other narratives discussed in this paper has encouraged homeowners and businesses to support solar energy, and the full support of the public has allowed narratives to shape the growth of the solar sector as a whole.

What are FITs?

Feed-in tariffs (FITs), put a legal obligation on utility companies to buy renewable energy at a premium rate. This system is usually set up over a guaranteed period to provide enough incentive for the installation of new solar energy systems, as developers are guaranteed to have consumers (World Future Council brochure, 2007)[16]. As a result, FITs drastically help in overcoming obstacles such as cost, a lack of legal framework, and market performance, which may cause initial hesitation.

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The purpose of this long-term guarantee is to provide a powerful economic incentive to homeowners and developers to invest in and have new solar power systems installed. By ensuring that they have a secure and profitable market for the power they generate, FITs remove the financial risk of renewable energy projects' high initial costs virtually entirely. As such, this policy helps overcome significant adoption barriers like exorbitant registration fees, market uncertainty, and the absence of a reliable legal framework (World Future Council brochure, 2007)[16].

Local Industry Development continued

Particularly, in 2007 and 2008, "Spain experienced an unprecedented boom in the deployment of solar photovoltaic modules, due in large part to a generous feed-in tariff" (Del Rio, 2014)[17]. However, this movement was followed by an immediate bust, as the government reduced the unsustainable costs of the FIT.

Specifically, solar PV received close to 50% of all support for renewable electricity in Spain, but it only produced 10% of its renewable energy (Del Rio, 2014)[18]. So if the costs were clearly unsustainable, how did solar PV receive so much funding?

During this time, the Spanish government framed FITs as not only in support of the environment, but also important for economic growth, job creation, and domestic industry development.

The role of this narrative was to build support for the FITs as a package of policy, made up of the legal obligation on utilities, premium rates, and guarantee period. The Spanish government placed the entire policy in a politically more acceptable and justifiable context and demonstrated how the contagious notion of economic opportunity could be used to drive the uptake of a multilayered and complex policy. Simply put, instead of trying to justify each component of FITs and convincing the public that the benefits outweighed potential downsides, the government framed FITs and solar PV as a package that would provide economic opportunity.

Rather than this narrative being used to push the government, this example of the local industry narrative was told by the government in order to get the public to support their policy. Policymakers promoted the release of solar PV as a way to boost local economies, especially in rural areas. In other words, the Spanish government emphasized that FITs would create jobs outside developed areas where the economy is worse.

This narrative helped secure support for the policy from a broad range of stakeholders despite its contribution to an unsustainable boom. The government's idea was that despite the unstable conditions as a result of the FITs, the economy would eventually stabilize and new jobs would emerge, especially in the rural areas of the country.

The early success of solar PV in Spain created a strong narrative imprint about solar energy as being beneficial to economic growth and job creation. In narrative economics, economic imprinting refers to the way that past events leave a lasting imprint, ultimately influencing future behavior. In the case of the local industry development narrative in Spain, even though the early growth was unsustainable, the strong initial perception of solar energy imprinted the belief that solar energy would fuel local industry development and create a new pathway for economic growth. These economic imprints have had a lasting effect over the past decade. In 2023, the installed capacity for solar PV was over 24.6 gigawatts, marking a 25% increase compared to the previous year (de l'pine, 2024)[19]. Additionally, solar PV capacity additions in Spain are expected to be between 32 and 52 gigawatts by 2028, representing continued growth in the sector.

Research from the Pew Research Center confirms that these theories on local industry development are fueled by narratives. Specifically, data shows that nearly 70% of Gen Z and Millennials agree that climate change should be a top priority to ensure a stable planet for future generations, and roughly 35% state that climate change is their top personal concern. Furthermore, around half of the Gen Z and Millennial population have engaged on social media with content around climate change, and talked about climate change at least 1-2 times (Tyson, 1)[17]. Ultimately, this data demonstrates the key role of narratives around climate change and renewable energy. Especially among the younger generations, these topics have become more prevalent, and the narratives around them have greatly influenced public opinion and driven engagement.

Another example of the local industry development narrative was in Germany. Like many other countries, Germany allocated the majority of its energy resources to mining. However, their approach gradually shifted to renewable energy closer to the turn of the century. With ambitious goals of reducing CO2 emissions by 55% before 2030, "after the introduction of PV cells in 1991, many local firms achieved the status of leaders where new technologies were concerned" (Elzbieta Rynska, 2022)[20].

Despite Germany being among the countries with the least hours of sunlight, it is still one of the largest solar producers in the world. The financial incentives as well as the goal of being completely renewable by 2035, have propelled Germany to one of the top solar power producers in the world. However, narratives were not the sole driver of the renewable energy boom in Spain. The initial surge was in large part due to the Energiewende policy framework, in which the Local Industry Development Narrative worked in tandem to fuel interest in the solar sector.

Ultimately, the Spanish and German governments presented solar energy as a reliable, eco-friendly way to produce energy. They spread the narrative that framed solar PV as not only beneficial to the environment but also as a catalyst for local economic growth and job creation. To spread this narrative, they leveraged the high contagion rate of issues surrounding the economy, as stories surrounding economic opportunity spread easily amongst the public. As a result, "the renewable energy sector in Spain includes 81,000 direct and indirect employees" and the growth

in the renewable energy sector is expected to create more "jobs and support vulnerable populations" (Kulkarni, 1)[21].

In this case, the Local Industry Development narrative was able to maintain high contagion due to it being centered around opportunity. By combining job creation with the idea of "supporting vulnerable populations," this narrative ensures its continued presence in public conversation, as it provides a hopeful story towards financial opportunity, a topic of widespread concern for the public.

Issues around job creation are especially appealing, particularly in urban areas with high concentrations of people. Because the Spanish government posed solar energy as a solution to the struggling job market, the narrative had a strong emotional connection, and as a result, was able to spread easily among the public.

Common Enemy Narrative

Throughout the renewable energy movement, activists and science organizations have identified a common enemy to rally their supporters and stakeholders. At the start of the climate movement in the 1960s, social activists struggled to make meaningful change, as efforts to create a cleaner climate were often too small. However, the rise of solar energy created a platform for environmental activists to unite and join forces in order to create a coherent social movement, and the identification of a common enemy made forming these coalitions easier. In addition, governments used the common enemy narrative to deflect failed renewable energy efforts. As a result, the solar and renewable energy industries have been able to grow, as they are backed by the combined support of activists and protected from failure. Although the common enemy throughout these movements constantly changed, the presence of a single entity to blame fueled each movement and allowed support for solar energy to grow at an exponential rate.

For example, the Spanish government reacted to the crash by blaming speculative behavior in the PV sector. For example, the government blamed people who were taking bets on the industry by bidding for "development rights with the intention of selling them on to third parties" (Del Rio, 2014)[18].

The government framed these people as the primary obstacles that prevented the country from maintaining a stable renewable energy industry. By spreading this narrative to the public, the government effectively justified its retroactive policy changes, which included cutting the FITs.

Through this narrative, the government was able to redirect the blame for the solar crash, ultimately conveying that the solar industry was not invaluable, but the people who were taking advantage of the benefits provided were at fault.

These events connect back to economic feedback loops that are relevant in narrative economics. The initial narrative around solar energy being innovative and superior caused a surge in its

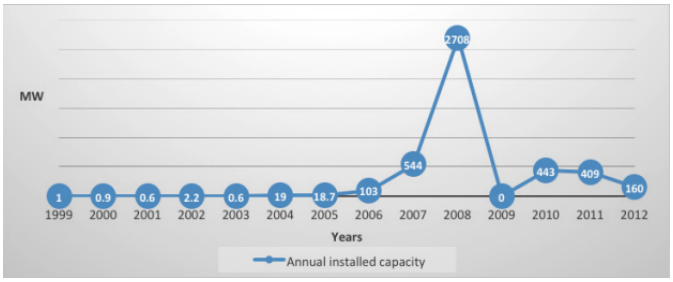

Fig. 4 Spain's annual installed solar PV capacity (MW), 1999-2012)[18]

usage, and this optimism around solar PV was self-reinforcing, eventually causing the benefits to be unsustainable. However, when the solar market crashed due to Spain's unsustainable incentives, a new feedback loop emerged. Instead of the loop being centered around optimism, the Spanish government started a loop of blame towards third-party investors, which masked the government's ineffective strategy to promote solar energy.

This implementation of the common enemy narrative is vastly different than typical common enemy framings. Specifically, instead of governments distributing the blame, the narrative is usually spread by activists and supporters to the public. For example, climate and anti-nuclear/fossil fuel movements frequently frame industries and governments as common enemies. Oftentimes, there is one dominant power that controls a large majority of a market, and this allows for an opportunity to unify activists. The common enemy narrative can be used to give voice to the public to fight larger corporations/governments, and has been used to push solar energy in many European countries.

For instance, Slovakia's solar movement faced multiple technological and economic barriers, including negligible FIT rates and state regulations. Despite the government making efforts to encourage solar energy, the limited results caused public pushback.

What gives the common enemy framing narrative such high contagion lies in the challenge of creating a perfect scenario. On the one hand, Spain implemented FITs that increased solar growth to the point of collapse, while Slovakia failed to provide enough support. However, in both cases, a common enemy was framed for the solar struggle. As a result, this narrative has allowed the solar market to continuously improve.

In recent years, this contagion of the common enemy narrative has been used by activists to promote solar and renewable energy. Specifically, as of 2023, over 1600 institutions have decided to divest from fossil fuel companies, collectively stripping over 40 trillion dollars in funds from these companies (IFMSA, 1)[22]. Only through this narrative were individual companies to make meaningful change, and the combined support of institutions - ranging from universities, governments, and pension funds - has been able to cause a meaningful change in the renewable energy

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industry.

Additionally, the common enemy narrative continues to be relevant in the solar industry because of its ability to mutate. Initially, the narrative worked to unite activists, but as climate change evolved to become a more well-known problem, the common enemy began to shift toward governments or people taking advantage of the advantages of solar PV.

World is Ending Narrative

Finally, the narrative that the world is ending has been spread by science organizations and environmental activists for decades. This narrative is fueled by the idea that the world is ending due to climate change and the harmful effects of fossil fuels, leaving solar and renewable energy as a possible solution. The strong focus on sustainability and the preservation of the environment has reached people across the globe, overpowering the competing views of anarchists and conservative politicians.

Recently, a global survey found that 68% of people support solar energy. Similarly, most Americans think the US should prioritize the development of renewable energy over fossil fuels. Over the past few decades, solar energy has been growing at an exponential rate, with FITs and funding at an all-time high due to the widespread fear of climate change as a result of traditional energy sources. In fact, the U.S. has not built a large coal power plant in the last decade, and as of September 2022, no developers have reported plans to build new coal power plants in the future (Figure 5).

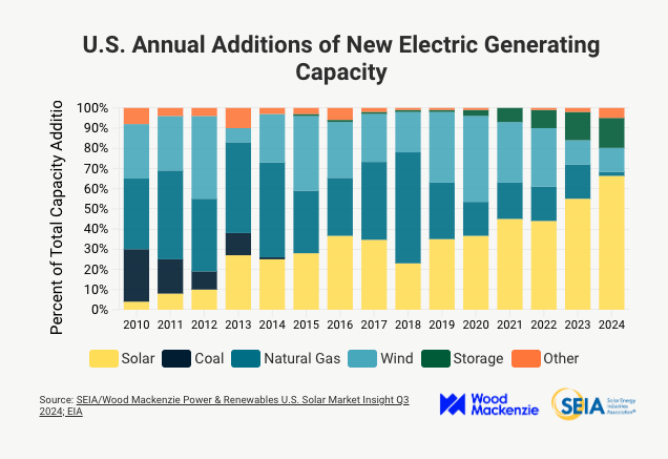

Fig. 5 U.S. Annual Additions of New Electric Generating Capacity (Solar Industry Research Data, 2024)[13]

Globally, the Paris Climate Agreement addresses climate change as a global emergency that "goes beyond national borders." It states that climate change is a worldwide issue that requires international cooperation, posing fossil fuels as a common enemy and pushing the narrative that the world is ending. To address the negative impacts of climate change, world leaders at the UN Climate Change Conference in Paris made the Paris Agreement in 2015. The Agreement set long-term goals on climate change, similar to the Kyoto Protocol in 1997. The worldwide goal of reducing global greenhouse gas emissions, periodically assessing collective progress, and even providing financing to developing countries to mitigate climate change all show the global impacts of these narratives.

In the US, recent policies such as the Clean Power Plan passed by Obama, as well as State FITs show a collective national push for renewable energy. The Clean Power Plan aimed to reduce carbon pollution from power plants, which were the nation's highest carbon emitters, while maintaining affordable energy prices. The Plan attempted to make fossil fuel power plants operate more cleanly, "while expanding the capacity for zero and low-emitting power sources" such as solar energy.

However, in order to achieve the goals of the plan, state governments started to implement feed-in tariffs. In 2008, California launched one of its earliest FIT programs. These tariffs encouraged the installation of solar panels, as renewable energy producers were able to sell their energy to utilities at set rates. This provided financial security as all energy produced was guaranteed to be sold. As a result, California residents and businesses in 2008 "installed a record 158 megawatts of photovoltaic panels," which is more than double the "78 megawatts installed in 2007" (Dickerson, 2009)[23] The financial benefits from FITs positioned California as a leader in the solar industry in the US and encouraged other states to implement similar policies. For example, states such as Florida, Vermont, and Hawaii all enacted similar FIT programs.

Furthermore, the Investment Tax Credit was also extended in 2015, when President Obama signed the Consolidated Appropriations Act. This extended the Solar ITC and maintained the 30% ITC for qualifying solar projects through 2019 (Congressional Research Service, 2021)[24]. This had noticeable effects on Solar Installations. Annual US solar installations nearly doubled in 2016, just one year after the extension passed (Figure 2). Finally, despite supply chain challenges slowing industry growth in 2022, "installations are expected to hold relatively steady around 40-45 GW annually over the next five years," signaling a strong forecast for the US solar industry in the coming years (SEIA, 2024)[13].

The world is ending narrative, which is closely related to narrative economics, as factors such as emotional resonance and high contagion rates have allowed it to persist despite solar energy's increased relevance. The contagion rate of The World is Ending Narrative stems from the fear of climate change, which has driven governments and entrepreneurs to consider implementing solar PV, and the fear of environmental collapse continues to fuel this narrative. In addition, the narrative's persistence showcases the low forgetting rates surrounding the topic, and consistent refinements to major policies and agreements such as

the Paris Climate Accords have kept the narrative relevant.

The narrative that the world is ending is a key reason for the lower diffusion rates. Because the narrative plays on fear, climate change remains at the top of people's minds. Fear about the effects of climate change leads to salience, causing people to constantly think and talk about it.

Therefore, environmental activists and proponents of this narrative leverage fear as a motivator, understanding that it causes people to embrace fighting climate change. These activists intentionally pull on fear and frame climate change as a powerful force that will eventually threaten our existence. By emphasizing the consequences of climate change, they encourage the adoption of solutions such as solar panels.

A study by Penn State researchers analyzed Twitter data to track opinions on renewable energy over time. They noted that during times of unusual weather patterns in Alaska, "20% of the users sent energy-related tweets, 15% sent energy-related tweets in February, 23% in March, and 21% in April 21%" (PennState, 1). These figures were noticeably higher than in similar months in the other two years, and demonstrate the increased public interest in renewable energy after just a short change in the weather. Ultimately, the "world is ending narrative" creates a perpetual cycle of fear, increasing public concern and driving the spread of the narrative.

Effects of the Four Narratives

In this paper, I have discussed how the Common Enemy Narrative, the Local Industry Development narrative, the World is Ending narrative, and the Technological advancement narrative have had an economic impact on the solar PV industry.

First, the Technological Advancement narrative framed solar energy as a superior, more advanced alternative to fossil fuels. This influence caused countries to adopt solar energy, as they feared being viewed as underdeveloped.

The Local Industry Development narrative emphasized job creation and economic growth in the solar industry and appealed to governments because of the possibility of becoming a leader in an emerging industry. This narrative influenced countries such as Spain and Germany to invest heavily in solar energy, despite Germany having low levels of sunlight compared to other economic superpowers.

Additionally, the Common Enemy narrative united activists and governments against fossil fuels, creating a platform for solar energy to grow. Activists were able to generate public support for renewable energy, and governments leveraged the narrative to redirect blame for failed PV initiatives away from the solar industry.

Finally, the World is Ending narrative raises concerns about climate change and places greater emphasis on sustainability. These clarifications help make laws and policies more environmentally friendly. For example, FITs help promote solar energy as a solution to climate change because they provide financial support for solar panels.

This has led to increased investment in the solar industry, which has led to lower costs and advances in solar technology. As a result, the industry continued to grow, and nuclear and coal power plants received less attention and funding.

These four narratives helped shape public opinion and created an environment where solar policies could gain traction. While policy was the main driver of solar PV implementation, narratives played an important role in legitimizing and amplifying those efforts. Furthermore, the significant cost reductions, increased energy efficiency, and beneficial competition between nations have allowed solar energy to become increasingly relevant. By creating jobs and increasing global innovation, solar energy has not only led to countless economic benefits but also helped create a greener future.

Key Lessons

This paper has discussed the influences that four narratives have had on the solar industry. These narratives helped exponentially grow the market. For example, many countries implemented FITs and financial incentives for solar installations. In addition, the UN and national governments pushed for a global transition towards solar and renewable energy to fight the ongoing climate crisis.

However, it is important to note that despite their global impacts, these narratives often go unnoticed. Oftentimes, major legislation and noticeable effects receive public attention. However, the underlying stories and narratives that allow for economic growth are often overlooked.

What makes narratives effective is their influence on public opinion, as popular sentiment has major effects on the economy. In the case of solar energy, the development of solar PV had limited capabilities for growth due to high costs and efficiency limitations. However, the surrounding narratives helped shape public perceptionpresenting solar as an innovative, job-creating solution to climate change. This perception, in turn, supported the policy and investment needed to scale adoption globally.

Without these narratives and resulting public support, solar energy would likely not have received the necessary investment and policy backing to overcome the traditional methods of energy production.

However, due to the lack of awareness, economic narratives can be easily manipulated. For example, as referenced earlier in the paper, the Spanish government blamed the national solar crash on individuals who were exploiting the benefits provided by solar incentives. In other words, despite the narrative failing after the initial success, the Spanish government redirected the blame away from the solar industry and used it as justification to cut back on FITs without harming solar energy's image.

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Discussion

This paper has discussed how many new policies and technological developments have unintentionally led to narratives. Oftentimes, narratives that developed from the innovative renewable energy acts created by governments and entrepreneurs had unintended consequences that either helped or hurt the industry. In addition, we have observed how narratives have the ability to serve as a substitute for expensive government policy interventions or as a way to overshadow government mistakes. Narratives rely on the power of storytelling, so governments can spread narratives without the need to create expensive new policies. However, narratives do not eliminate the need for policy creation. Policymakers should focus legislation on counteracting and redirecting the unintended narratives that arise. By creating new narratives and facilitating effective policy creation that redirects harmful narratives, governments can make meaningful changes in reaching their renewable energy goals in a cost-effective way.

Solar energy has been marketed as an innovative approach to energy production, leading entrepreneurs and emerging businesses to market themselves as more technologically advanced than traditional energy sources. As a result, governments and local industries have invested heavily in the solar industry, viewing it as a way to break away from the traditional means of energy production.

This commitment to renewable energy aligns with the global trend towards sustainability. If developed countries do not transition to renewable energy, their global perception and prestige will diminish. As public awareness around climate change and solar energy grows, the demand for a more sustainable future increases.

In addition, the growing climate change crisis has greatly influenced public opinion, leading to an increase in renewable energy acts worldwide. Furthermore, concerns around job security for coal and power plant workers have been addressed through the growing narrative that solar energy will create a foundation for new local industries, leading to massive job opportunities.

Countries such as the US have stopped importing solar materials from other countries, allowing the US to focus on its own solar development. This shift results in healthy competition between countries that aim to become leaders in the solar industry. By focusing on local production, countries can enhance their own technological production, creating national job opportunities backed by the government.

In conclusion, the narratives around solar energy have served as a catalyst for change in public opinion. It is crucial to examine the influence of narratives on the economy, as they are the backbone of economic fluctuations. Future research could expand upon this study by exploring how narratives shape the adoption of other renewable energy sources, such as wind and geothermal power. In addition, emerging technologies such as battery storage and smart grids are gaining relevance, and exploring these expansions would help policymakers and entrepreneurs effectively drive sustainable energy initiatives on a global scale.

Limitations

As Shiller states himself, narrative analysis is not perfect with causality. However, what makes the method useful is its ability to study dynamics that other methods (even methods with better causal identification) can not get at.

Additionally, it is important to note that narratives were not responsible for 100% of policy change or solar energy intrigue. Rather, they were one piece of the puzzle that helped solar PV expansion across multiple countries. It is important to note that Shiller himself explicitly discusses this as a challenge of studying narratives and weakness of the method.

Another limitation of this paper lies in its inability to look at the effect of, for example, why one narrative successfully led to adoption while another did not, and it is fundamentally unable to explain the reasons behind such differences for all circulating narratives. In addition, this paper only discusses narratives that promoted solar adoption rather than ones that hindered it.

Conclusion

This paper examines the role of narratives on the diffusion of green energy policies across multiple countries around the world. In some cases, these narratives (Local Industry Development, The World is Ending, Technological Advancement, Common Enemy) have helped in promoting renewable energy adoption, and the findings in this paper suggest that narratives can substitute for expensive policy interventions and keep ideas circulating in public. The broader implication of the paper is that narratives can serve as drivers of renewable energy adoption and other global issues, and when paired with effective policy, well-crafted narratives can help countries create a more sustainable future.

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