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Selling stories of techno-optimism? The role of narratives on discursive construction of carbon capture and storage in the Japanese media

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ABSTRACT

Great expectations have been expressed for carbon capture and storage (CCS) as a key climate change mitigation option, primarily because CCS possesses the political capital to reconcile continued use of fossil fuels with greenhouse gas emissions reduction. However, technological innovation of CCS has recently stagnated, and therefore, CCS still exists largely as a technological imaginary, is shaped more by narrative than by physical reality. This study examines how narratives or imaginaries of CCS technology were constructed in four major Japanese newspapers from 2006 to 2013. Based on a discourse analytic approach, we identify three dominant storylines of CCS: (1) the *promise* of large CO_2 storage capacity; (2) the *compatibility* with the fossil energy regime; and (3) the *forefront* of high-tech innovation. The results show that all three storylines are strongly in favor of CCS, inflating blind optimism in the technical prospects of CCS while ignoring the many risks and uncertainties around it. Given the complexities of CCS as a socio-technical system, however, the role of media narratives is to enhance broader social learning about CCS. The paper argues that more plural, balanced, and critical narratives are required to sustain a sound balance between uncertainty and optimism over CCS.

1. Introduction

Over the past few decades, carbon capture and storage (CCS), a technology of capturing carbon dioxide (CO_2) emitted from large emission sources such as coal-fired power plants and burying it in deep underground geological formations, has gained prominence in policy discussions on climate change mitigation [1–3]. The release of the Intergovernmental Panel on Climate Change (IPCC) Special Report on CCS (SRCCS) in 2005 [4], in particular, marked a critical moment; since then, CCS has been considered a major option for reducing global greenhouse gas (GHG) emissions [1,5].

Experts in energy and climate policy have expressed great expectations for CCS and created an optimistic narrative [6]. It has been repeatedly stated that CCS is a political necessity for meeting the ambitious target of limiting the global average temperature increase to 2 °C above pre-industrial level, a long-term goal inscribed in the Paris Agreement, adopted at the Paris climate summit in December 2015 (e.g. [7,8]). The latest IPCC fifth assessment report concluded that the stringent stabilization level of GHG atmospheric concentrations to 450 ppm CO_2-equivalent by 2100, known to be consistent with the 2 °C target, cannot be achieved “if additional mitigation is considerably delayed or under limited availability of key technologies, such as bioenergy, CCS, and their combination (BECCS)” ([9], p. 16). Many modeling analyses of future climate scenarios construct a dominant narrative that the large-scale deployment of CCS technology is essential and inevitable for the rapid and deep decarbonization of energy systems, imparting high hopes for CCS [10].

However, great enthusiasm for CCS is at odds with the ‘cold reality’ of the slow progress in CCS innovation over recent years—numerous demonstration projects have been postponed, suspended, or canceled [11–14]. While economic models projected that CCS could significantly curb long-term mitigation costs [9], the immediate investment cost required for CCS demonstrations paradoxically hampered further development [12,14]. The ambitious goal of the International Energy Agency (IEA) to establish 100 large-scale CCS demonstration projects by 2020, which was first proposed in its 2009 report [15], has been radically scaled back to 30 projects in operation [16]. To date, only one integrated CCS system in a coal-fired power plant—often considered as a major application of CCS technology—is operational, at the Boundary Dam facility in Saskatchewan, Canada, which started in October 2014 [14]. This suggests that the initial prospect of the rapid progress of CCS innovation was too optimistic or overhyped, requiring a recognition of the ‘new reality’ of CCS, i.e., “a more measured, realistic one, less prone to hype and exaggerated expectations” ([17], p. 212).

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Thus, there is a gap between the expectation for CCS as a key mitigation option anticipated in modeling scenarios and the reality of the immaturity of CCS technology for large-scale deployment. CCS still exists largely as—and is shaped by—narratives or "sociotechnical imaginaries" [18], which describe what futures are attainable and prescribe what futures are desirable, rather than physical realities. This means that narratives could play a performative role in determining the future trajectories of CCS and, more generally, of the low-carbon energy transition [19]. Because CCS is still in the demonstration phase and in situ demonstrations at specific sites are invisible to societal audiences, social learning of CCS relies heavily on cultural representations and intermediaries, such as news media stories that can be widely circulated in society (cf. [20,21]). Therefore, exploring CCS narratives in the media becomes a pivotal reference point for understanding the broader public discourse on CCS.

This paper examines how narratives or imaginaries of CCS technology were constructed in the Japanese media during the period from 2006 to 2013. While our study is based on an analysis in a specific national context (i.e., Japan) and public discourse on CCS differs across national borders [1,22], the scope of this paper more generally focuses on the role of narratives in shaping and enacting energy policy debates (cf. [23]). Our aim is to discuss how narratives can contribute to determining what is politically plausible and desirable—and thereby what is made obscure—regarding CCS.

2. Background

In this section, we delineate some key issues in the CCS debate, after a brief sketch of the historical development of CCS technology in Japan, which will provide a necessary background for understanding the media narrative of CCS.

2.1. A brief history of CCS development in Japan

Due to the oil crisis in the 1970s which had a severe impact on the Japanese economy, Japan has a long history of government-led, large-scale research and development programs in new energy technologies. During the period from the 1970s to the early 2000s, massive public funding was invested in improving energy efficiency and developing new energy technologies through programs established by the Ministry of Economy, Trade and Industry (METI), formerly the Ministry of International Trade and Industry [24]. As part of such governmental programs, research and development on CCS—in particular, CO_2 capture—technology was promoted. As a result, Japanese industry became a pioneering player in the field of capture technology.

The Japanese government also proposed the so-called 'New Earth 21' program in 1990, which aimed at promoting new technology innovation for climate mitigation [25]. At the center of this program, the Research Institute of Innovative Technology for the Earth (RITE) was established in July 1990, under the jurisdiction of METI. Since its establishment, RITE has been a central hub of CCS research in Japan. In 2000, RITE conducted Japan's first pilot project of CO_2 geological storage in Nagaoka, Niigata, completed in 2007.

At the governmental level, METI has been a central player in crafting Japan's national CCS policy [26]. In 2006, METI envisioned a plan for the commercialization of CCS technology by 2020. This vision was followed up and endorsed by the government's cabinet decision in July 2008, after the G8 Hokkaido Toyako Summit, where its official statement addressed CCS as a key climate mitigation measure and envisaged the launch of 20 large-scale demonstration projects globally by 2010 [27].

In 2012, Japan's first full-scale demonstration project, funded by METI, was launched in Tomakomai, Hokkaido [28] and came into operation in March 2016 [29]. This project is being conducted by Japan CCS Co., a private consortium of more than 30 Japanese companies from various industrial sectors, established in 2008, whose business is exclusively centered on CCS technology. It is worth noting that, unlike other countries with leading CCS innovation, such as the US, Canada, Australia, or Norway, no powerful fossil fuel industry exists in Japan. This characteristic of Japanese economic structure perhaps drove Japanese industry into developing technology for CO_2 capture more than storage.

Most recently, in November 2013, the Japanese government announced a new plan for climate action, setting out a long-term goal of at least 50% reduction of global GHG emissions by 2050 [30]. At the core of the new plan, the Japanese government stressed the importance of innovation in low-carbon technology, listing CCS as a key technology, and promised to invest a total of 110 billion US dollars in technology innovation over five years.

2.2. Uncertainty and controversy around CCS debate

The debate on CCS is surrounded by controversy and uncertainty, which have remained obstacles for CCS innovation [31,12]. As much as CCS inspires great expectations for large GHG emissions abatement, it receives strong criticisms too. Because CCS is by definition an end-of-pipe technology that perpetuates the continued exploitation of fossil fuels, some have condemned the investment in CCS as a fossil fuel subsidy that governments should divest from [32]. The controversy over CCS touches upon many—technical, economic, social, political, and legal—dimensions of uncertainties regarding the feasibility and viability of CCS [31,12]. This controversy also concerns the desirability of CCS, that is, people's worldviews regarding the scale and pace for change from the present fossil-based energy regime to the low-carbon energy future (cf. [32]). What role CCS can play in a sustainable energy transition is part of a broader question about what kind of future we want to live in [17]. Thus, the legitimacy of CCS does not rest on technical or economic feasibility alone; it also depends on social and political desirability.

Among others, one of the key issues regarding CCS is storage safety because the success of CCS ultimately depends on whether CO_2 storage can be secure over long periods of time. CO_2 leakage from geological formations might not only undermine the effectiveness of CCS for climate mitigation but also have harmful environmental and health impacts [33]. Some researchers raise concerns over the induced seismicity associated with geological CO_2 injection [34]. Although many experts and engineers consider the security of geological storage to be technically manageable [4,33], there remain uncertainties and risks of potential leakage, and scientists do not necessarily agree on what is considered 'safe' and to what extent of leakage is 'acceptable' [35,31,11]. The perceived risk or allegation of leakage—either true or not—may raise public anxiety, and in some cases, invalidate application of CCS (cf. [36]). Importantly, managing the risks of CO_2 storage is linked to legal and political uncertainties about liability for long-term monitoring of stored CO_2 [37,33].

The issue of economic uncertainties over the costs of CCS is important too. A lack of financial viability has hampered the progress of CCS demonstrations; this partly resulted from wider policy and regulatory factors, such as the absence of carbon pricing and low public awareness of climate change among others [31,13]. As Markusson et al. [31] argued, advocates of a technology are often entrenched in so-called 'appraisal optimism' to underestimate its costs, and this is arguably true with CCS demonstrations [14]. The increased cost of CCS technology, however, has larger political implications. That is, further investment in CCS could incur sunk costs and hence create a political path dependency [32], reinforcing 'fossil fuel lock-in' or 'carbon lock-in', which might perpetuate the status quo of the incumbent fossil-based energy regime[1] [38–40]. In fact, for large-scale CCS deployment,

[1] It is, however, worth noting that 'carbon lock-in' might possibly be avoidable if CCS technology is applied in other forms, such as Bio-Energy with CCS (BECCS) or industrial CCS (e.g., steel and cement), instead of fossil fuels (cf. [39]).