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1 Challenges for social impact assessment in coastal regions: a case study of the Tomakomai
2 CCS Demonstration Project

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14
15 Abstract

16
17 This paper assesses challenges for social impact assessment (SIA) for coastal and offshore
18 infrastructure projects, using the case study of the Tomakomai Carbon Capture and Storage
19 (CCS) Demonstration Project in Hokkaido, Japan. Interest in SIA and linked concepts such as
20 social licence to operate is growing, yet marine environments also have potential to raise
21 additional complexity in project governance. Drawing on qualitative research conducted in
22 Tomakomai and Japan more widely across the project development and implementation
23 phase, the paper argues that building an understanding of the social, cultural and historical
24 relationship between the community, industry and the sea is crucial to understanding the
25 neutral or cautiously supportive response of the citizens and stakeholders in Tomakomai to the
26 project. Moreover, effective SIA in coastal regions needs to find a way to account for - or at
27 least make visible - these complex relations between society and the sea. Based on the
28 findings, it is suggested that developers or policymakers overseeing SIA in coastal regions
29 ought to pay extra attention to the extent to which developments like CCS are viewed by
30 communities as 'new' as opposed to a continuation of existing activities in the sea; to the
31 importance of engagement on monitoring during the project operations phase; and to the non-
32 economic values such as pride and identity which communities and stakeholders may derive
33 from the sea.

34
35 Keywords

36
37 carbon dioxide capture and storage; coastal communities; social impact assessment; social
38 licence to operate; Tomakomai CCS Demonstration Project.

39
40 Highlights

- 41
42
- 43 • Evaluate social dimensions of Japan's first large-scale CCS demonstration;
 - 44 • Refine extant social impact assessment principles with specific coastal focus;
 - Cultural and historical relationship with sea key to understanding community

- 45 response;
- 46 • Coastal SIA needs to specifically accommodate community relations to sea;
- 47 • Complexity in marine environments makes careful in-depth SIA even more important.

1

2 1. Introduction

3

4 Interest is growing in social impact assessment (SIA), defined by the International Association
5 for Impact Assessment (IAIA) (2003: 6) as "the process of analysing, monitoring and
6 managing the intended and unintended social consequences, both positive and negative, of
7 planned interventions (policies, programs, plans, projects) and any social change processes
8 invoked by these interventions." The potential for infrastructure projects to have effects in
9 nearby communities has long been understood, yet proliferation of concepts like SIA and
10 'social licence to operate' – that is, an informal agreement based on ongoing approval and
11 broad acceptance of society towards an operator conducting their activities in the local area
12 (Prno and Slocombe, 2012; Rooney et al, 2014) – is comparatively more recent. These ways
13 of thinking seek to more formally understand best practice in assessing the social dynamics of
14 new developments from the pre-project stage across the entire project life cycle, in a similar
15 manner to environmental impact assessments (EIAs).

16

17 In principle, it is argued that both EIA and SIA ought to be considered early on in the
18 development process to reduce the probability of negative environmental and social effects
19 arising from new developments (Barrow, 1997). Nonetheless, EIA and SIA have to an extent
20 developed as separate entities (Slootweg et al, 2001), with legislative and conceptual
21 differences between the two. On one hand, the undertaking of an EIA has become a legislative
22 requirement for proposed new developments in many jurisdictions (Cashmore, 2004). SIA, by
23 contrast, has evolved from a process originally undertaken as a component part of an EIA to
24 meet regulatory demands, towards a much wider-reaching set of actions aimed at giving
25 communities the ability to consent to developments prior to project commencement

26 independent of environmental impacts (Esteves et al, 2012). Vanclay (2012) adds that whilst
27 environmental impacts begin when project construction commences, social impacts may
28 commence as soon as there is a rumour something may change. There is increasing attention
29 to the interface between EIA and SIA, Sloodweg et al (2001) holding that full understanding
30 of the 'impacts' of a development necessitates holistic understanding of environmental and
31 social effects. Reflecting the notion that the scientific basis of an EIA may itself be socially
32 and politically informed (Cashmore, 2004), O'Faircheallaigh (2010) sees greater social
33 participation in EIAs as a means of connecting environmental and social impact assessments.
34 However, O'Faircheallaigh also sees the need for greater clarity around the extent to which
35 societal involvement can influence the outcome of impact assessment decisions. In short,
36 effective SIA necessitates understanding not only of how a development may change a
37 community economically and socially, but also of how EIAs and evaluations of environmental
38 effects arising from proposed developments are perceived by communities and to what effect.

39

40 Carbon dioxide capture and storage (CCS) is one such infrastructure technology where
41 developers, policymakers and academics are moving towards means of systematically
42 evaluating the social dynamics of proposed projects, with particular interest in how
43 assessment of potential environmental effects are understood by society (e.g. Dowd and
44 James, 2014; Kaiser et al, 2015; Hall et al, 2015). CCS involves three broad stages. The first
45 is separating and capturing carbon dioxide (CO₂) emissions from coal- or gas-fired power
46 stations or CO₂-emitting industrial sources such as steel, cement or chemical works. The
47 second is transporting the captured CO₂ emissions, usually by pipeline or ship. The third is
48 storage, whereby the CO₂ is injected into geological structures deep underground (for
49 instance, depleted hydrocarbon reservoirs or saline aquifers) where it remains securely stored.
50 These storage sites may be either onshore, or offshore under the seabed. At the storage stage,

51 captured CO₂ may simultaneously be used to extract remaining oil from depleted reservoirs
52 through processes of enhanced oil recovery (EOR). The aim of undertaking CCS is to reduce
53 the amount of CO₂ entering the atmosphere from existing and ongoing electricity generation
54 and industrial activity, hence reducing the likelihood of dangerous climate change (IEAGHG,
55 2017). Proponents of CCS argue it is a necessary technology to meet climate change
56 mitigation targets due to the continued role of fossil fuels in electricity production; the
57 difficulty at present of finding other ways to reduce CO₂ emissions from industrial processes;
58 and the possible need for ‘negative emissions’ technologies in the future which depend on
59 CCS-related transportation and storage processes (Global CCS Institute, 2016).

60

61 CCS is at the demonstration and early deployment stage globally, and social aspects identified
62 for CCS-related projects which have come to fruition include perceived employment or
63 economic benefit through continuation of regional subsurface operations (e.g. Boyd (2015) on
64 the Weyburn project in Canada), community concerns over uncertainty and long-term effects
65 (Mabon et al (2015) on the QICS experimental release in west Scotland) and also wider issues
66 around fairness and transparency in decision-making processes (e.g. Anderson et al (2012) on
67 the Otway Project in Australia). Injection of CO₂ into offshore geological structures has been
68 argued to remove some of the most pressing social issues such as perceived risk and effects on
69 house prices (Scott et al, 2014). Yet offshore CCS may also give rise to new social issues
70 relating to legislation and governance challenges given the complexity of marine planning
71 (Milligan, 2014), or to increased concern over pipelines given the need for more extensive
72 transportation networks to carry CO₂ from onshore capture points to offshore storage sites
73 (Ashworth et al, 2015). This interest in the social and political dimensions of offshore CO₂
74 storage is important given the increasing interest in offshore storage sites for reasons of
75 geological suitability and/or socio-political factors in areas like China (Partain and Faure,

76 2016), Brazil (Roman, 2011) and Norway plus the wider Nordic region (Haug and Stigson,
77 2017).

78

79 This paper takes as its focus the Tomakomai CCS Demonstration Project in Hokkaido,
80 northern Japan, which injects CO₂ into the seabed off Tomakomai City. Despite recent
81 negative experience in Japan of the relationship between energy infrastructure, seismic
82 activity and the sea; the large urban centre in Tomakomai; and the cultural and political
83 significance of fisheries to the area, the Tomakomai CCS Demonstration Project appears to be
84 proceeding through the execution stage without significant social issues arising. Given this
85 challenging socio-political context, the purpose of this paper is therefore to (a) understand
86 why the Tomakomai project has managed to reach the execution stage, and how potential
87 challenges were surmounted along the way; and (b) use these findings to refine and develop
88 existing SIA thinking with a specific focus on challenges for coastal regions. To do so, social
89 science data collected in Tomakomai and beyond over the course of the project development
90 and commencement phase is assessed.

91

92 2. Scholarly and policy context: governing new technologies in marine environments

93

94 Beyond CCS, marine and coastal environments offer significant opportunity in resolving
95 resource and climate challenges. At the same time, however, in the contexts of the developing
96 of new shipping routes (Dawson et al, 2014); deep-sea mining (Roche and Bice, 2013) and
97 offshore renewable energy (Wiersma and Devine-Wright, 2014) there is recognition that
98 processes taking place out at sea are not immune to societal issues. Challenges raised in this
99 regard include not only the possibility for new offshore developments to negatively affect
100 other marine economic activities such as fishing or shipping, but also the potential that

101 changes to the sea could affect culturally significant landscapes and/or raise ethical and moral
102 concerns over who has the right to make decisions about the future trajectory of such
103 landscapes (e.g. Haggett, 2008). The Brent Spar controversy (Side, 1997) also demonstrates
104 how opinion shapers such as environmental NGOs can be concerned about - and draw wider
105 societal attention towards - actions taking place far away from land.

106

107 Vanclay (2012) suggests assessment of social impact in coastal management should not
108 require significantly different processes to existing well-developed land-based impact
109 assessments. It is worth noting, however, that marine and coastal environments do introduce
110 some additional complexity. Emerging marine resource management processes which require
111 mapping and formal division of the sea, such as marine spatial planning, can run up against
112 more traditional ideas of 'ownership' or stewardship of the sea held by communities (Smith
113 and Brennan, 2012). This in turn can lead to suspicion of or hostility towards management
114 decisions imposed from on high by 'outsiders' perceived as lacking full understanding of the
115 interplay between society and the sea (McKechnie, 1996). In any case, the flows of water
116 across boundaries means marine governance requires engagement of a much wider range of
117 actors and extends the distance across which risk communication may need to take place
118 (Mabon and Kawabe, 2017). Moreover, questions around long-term liability, transboundary
119 issues, and ongoing scientific research into ecosystem effects (e.g. Grehan et al, 2009; Jabour,
120 2010; Proelss and Gussow, 2011) across a suite of new ocean technologies indicate rigorous
121 SIA procedures are particularly important in a marine context

122

123 Existing governance and decision-making processes for offshore developments may hence
124 require further refinement to address the breadth and complexity of societal concerns
125 engendered by marine environments. This paper thus takes Vanclay's (2012) principles for

126 social impact assessment (SIA) in coastal management, and uses the case study of the
127 Tomakomai CCS Demonstration project to draw out more specific challenges for undertaking
128 SIA for offshore or coastal projects. The aim is not to provide solutions for offshore and
129 coastal SIA. Rather this article uses a case study where there is high potential for controversy
130 - as is now explained - to draw attention to challenges to which project operators, municipal
131 governments and national-level regulators and policymakers ought to pay cognisance when
132 assessing the social impacts of a new development in a coastal region.

133

134 3. Case study: the Tomakomai CCS Demonstration Project

135

136 Tomakomai City (population approximately 175,000 (Tomakomai City, 2016)) is located in
137 the south of Hokkaido, the northernmost island of Japan (see Figure 1). As a port city,
138 Tomakomai's economy is heavily reliant on carbon-intensive industries. It is home to one of
139 the largest oil refineries in Japan, an oil storage depot, a coal-fired power station, and a sea-
140 freight port as well as a major paper factory. The region surrounding Tomakomai also hosts
141 steelworks in Muroran, and a declining coal industry with coal-bed methane potential in
142 Yubari. Moreover, Tomakomai also has extensive coastal fisheries, with a particular focus on
143 Sakhalin Surf Clams.

144



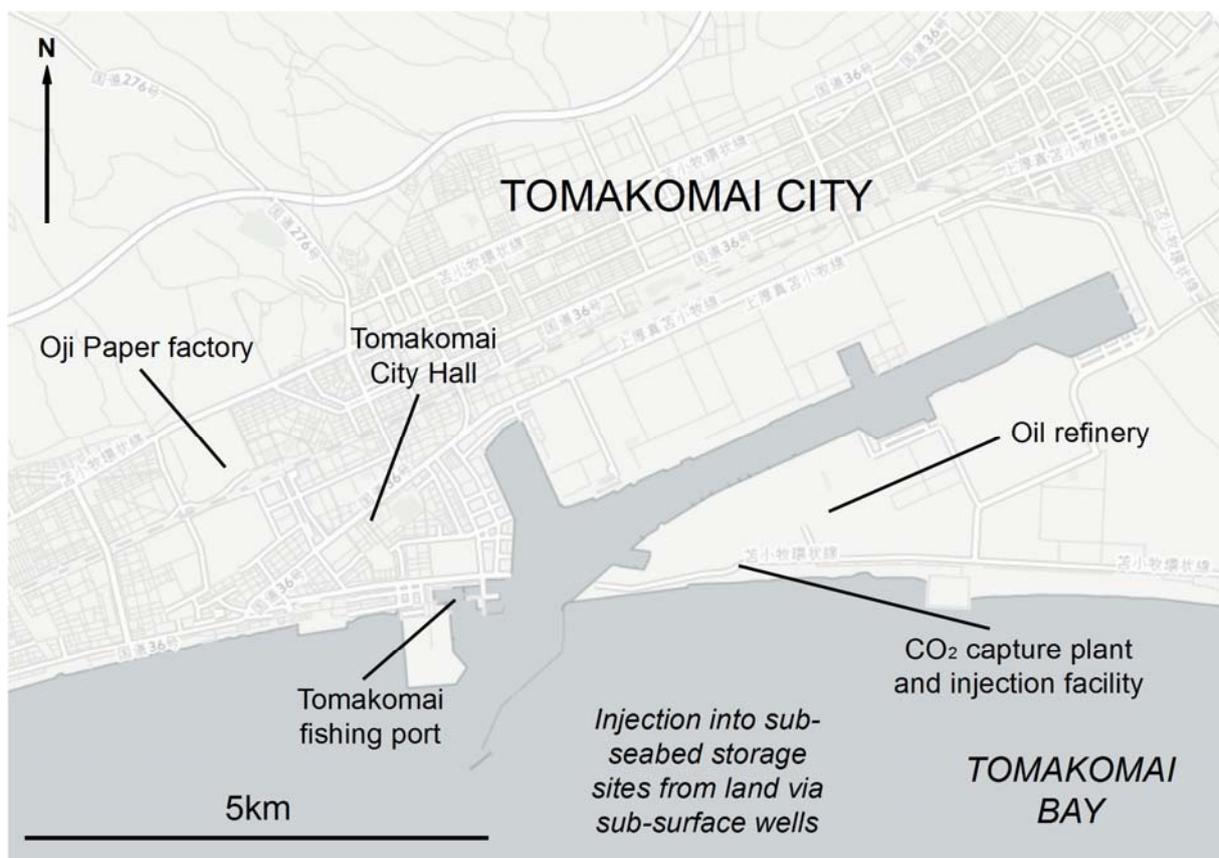
145

146 *Figure 1: Location of Tomakomai City within Hokkaido (Adapted from map tiles by Stamen*
147 *Design, under CC BY 3.0. Data by CartoDB and OpenStreetMap, under ODbL).*

148

149 Tomakomai was selected to host Japan's first CCS demonstration due to its geological
150 suitability and early completion of site characterisation (Abe et al, 2013). CO₂ is captured
151 from hydrogen produced by a facility within the grounds of an oil refinery to the east of the
152 city, and injected into permanent storage under the bay off the coast via wells drilled from the
153 onshore injection facility site and running under the seabed. This storage consists of two
154 reservoirs – one in the Takinoue Formation (approximately 2,400m to 3,000m below the
155 seabed, storage point about 4km offshore), and the other in the Moebetsu Formation
156 (approximately 1,100m to 1,200m below the seabed, storage point about 3km offshore)
157 (Tanaka et al, 2014) (see Figure 2). Construction of the project commenced in 2012, and
158 injection began in spring 2016. The project is expected to continue operating until 2020

159 (Japan CCS Company, 2017). In addition to monitoring marine species and seawater to ensure
160 sequestered CO₂ does not enter the sea water, continuous observation monitors injection and
161 seismic activity on the sea floor (Tanaka et al, 2014). CCS is significant for Japan beyond
162 Tomakomai as the country is currently aiming to identify future offshore storage sites with a
163 view to the practical use of CCS in future. This is seen as contributing to Japan's intended
164 nationally determined contribution (INDC) under the Paris Agreement of a 26% reduction in
165 greenhouse gas emissions by 2030 compared to 2013 (Okajima, 2016).
166



167
168
169 *Figure 2: Location of CCS Demonstration Project within Tomakomai City (Adapted from map*
170 *tiles by Stamen Design, under CC BY 3.0. Data by CartoDB and OpenStreetMap, under*
171 *ODbL).*

173 What is distinct about the Tomakomai project is that it is the one of the first CCS projects
174 globally to take place close to a large centre of population. The population of Tomakomai –
175 approximately 175,000 (Tomakomai City, 2016) – is significantly higher than existing 'host
176 communities' for CO₂ storage, such as Estevan adjacent to the Canadian Boundary Dam
177 project (population approximately 12,000) and Ketzin which hosted the German CO₂Sink
178 demonstration (population approximately 6,000). CO₂ is injected into the geological structures
179 beneath Tomakomai Bay, relatively close to the city and also to fishing grounds. It is therefore
180 a useful case study to assess how stakeholders and citizens weigh up the risks and benefits of
181 a new low-carbon energy technology taking place in the local environment, and to evaluate
182 the role of both physical and social sciences in identifying viable and acceptable pathways to
183 low-carbon futures for coastal city regions.

184

185 4. Method

186

187 It is important to be clear that the data on which this paper is based was not collected as part
188 of a formal SIA process, rather through academic research undertaken by the lead author.
189 Nonetheless, the data collection and analysis techniques used are similar to those discussed in
190 much of the SIA literature (e.g. IAIA, 2015), with a qualitative methodology being adopted in
191 order to develop in-depth understanding of the social and cultural factors which may drive
192 community response to the CCS project and also inform social impacts. In particular, data was
193 collected through the following means.

194

195 4.1. In-depth interviews

196

197 Semi-structured in-depth interviews were undertaken in Tomakomai, analogous communities

198 in southern Hokkaido, and elsewhere in Japan (in order to access relevant expertise) between
199 June 2014 and June 2016. This covered the phase from project development through to the
200 commencement of injection. Based on existing knowledge of community dynamics in
201 Tomakomai gained by the research team through physical science monitoring, key
202 stakeholders (e.g. municipal government, fisheries cooperatives, port authority) who would be
203 able to talk knowledgeably and in-depth about sub-seabed CO₂ storage in Tomakomai (and
204 also give insights into perceptions of CCS held by the wider community) were sampled. To
205 give a broader sense of environmental and social context within which the Tomakomai project
206 takes place, these were supplemented with interviews with comparable stakeholders in nearby
207 cities and also with policymakers at the regional level. For balance, academics and non-
208 governmental organisations (NGOs) independent of the project, who would be able to discuss
209 monitoring and socio-political challenges around CCS more critically, were also interviewed.
210 The overall aim of sampling was hence to elicit a broad range of perspectives on the social,
211 political, cultural and economic context within which the Tomakomai project developed.

212

213 A full list of people interviewed is provided in Table 1. In total, 30 people were interviewed
214 across 17 interviews. Whilst this may seem like a small sample, given the new and potentially
215 unfamiliar nature of CCS technology in Japan and the research aim of identifying challenges
216 and nuances for extant SIA procedures, working intensively with a smaller range of
217 participants who would be able to give in-depth insight into the social context in Tomakomai
218 (c.f. Chase, 2005) was considered to give richer and more valuable data than a more extensive
219 sample of people with more limited knowledge. In any case, samples of this size have been
220 considered appropriate in analogous qualitative marine governance research, especially when
221 combined with documentary methods as outlined in Section 4.2. (e.g. Kahmann et al, 2015;
222 Fraser et al, 2017).

Organisation/expertise	Location	Number of people	Sector
Japan CCS Company Head Office	Tokyo	3	Developer
Tomakomai City Government, Industrial Development Section	Tomakomai	2	Local government
Japan CCS Company Site Manager	Tomakomai	1	Developer
Regional climate change NGO	Maebashi	1	NGO
National climate change NGO	Tokyo	1	NGO
Academic specialising in geophysics for subsea activity	Tokyo	1	Academia/research
Tomakomai Port Authority	Tomakomai	2	Public sector
Hokkaido Government, Environment and Energy Group	Sapporo	2	Regional government
Hokkaido Government, Climate Change Mitigation Group	Sapporo	3	Regional government
Tomakomai City Government, Industrial Development Section	Tomakomai	3	Local government
Tomakomai Fisheries Cooperative	Tomakomai	2	Cooperative
Regional environmental NGO	Sapporo	1	NGO
Yubari City Planning Department	Yubari	1	Local government
Community group	Yubari	3	NGO
Muroran Port Authority	Muroran	1	Public sector
Regional development association	Tomakomai / Sapporo	1	NGO
Academics specialising in geology for subsea activity	Kyoto	2	Academia/research

224

225 *Table 1: List of interviewees sampled.*

226

227 All interviews were undertaken in Japanese. The interviews were semi-structured, with
228 flexibility to follow up on issues participants themselves deemed to be significant rather than
229 those the researchers assumed to be of importance. Nonetheless, each interview sought to
230 cover (a) the respondents' knowledge of and views on CCS; (b) their opinions on climate
231 change and environmental issues in the locality and Japan more widely; (c) their insights into
232 the socio-cultural situation in Tomakomai and southern Hokkaido (or, for interviewees based

233 further away, more general thoughts on the relationship between energy infrastructure and the
 234 sea in Japan); and (d) the specific relationship of the respondents' sector to CCS (e.g.
 235 opportunities and challenges CCS raised for port activities or fisheries). A sample interview
 236 schedule is included as Supplementary Material. Analysis proceeded by drawing the main
 237 points out of each interview, and clustering these into thematic groups through a grounded
 238 theory approach (Strauss and Corbin, 1997). This clustering exercise acted as a heuristic tool
 239 to enable the research team to identify key issues around SIA in coastal regions arising from
 240 the data. In Section 5, the interviews in which the points raised were made are denoted in
 241 footnotes.

242

243 4.2. Archive research

244

245 Archival research was undertaken at Tomakomai City Library and Hokkaido Library, to
 246 understand the environmental history of the area as well as social and economic trends over
 247 time. Table 2 lists the sources consulted and their justifications. The aim of this was to obtain
 248 additional explanation on the history of infrastructure development in the environment in
 249 Tomakomai, which may inform or explain present-day attitudes to the CCS project.

250

Material	Document Type	Location	Justification
<i>Tomakomai Minpo</i> newspaper, 1960s-present	Local newspaper	Tomakomai City Library	Local newspaper shows historical social context of infrastructure and environmental issues.
Environmental Impact Assessments for Tomatoh-Atsuma Coal Power Plant; Idemitsu Refinery; and East Tomakomai Industrial Area	Environmental Impact Assessments	Tomakomai City Library	Historical EIAs give insight into previous environmental issues in Tomakomai, and also social licence of industries/operators now perceived as related to CCS.
Local government	Local government	Tomakomai City	Historical context of

reports on marine pollution (1920s-present)	environmental data and reports	Library	marine pollution - especially fisheries - indicates potential perceived social impacts from CCS.
Tomakomai City Census (1976-present)	Local government census	Hokkaido Library, Sapporo	Understand social trends (e.g. employment, income) in Tomakomai over time.
Hokkaido Census 2015	Prefectural census	Hokkaido Library, Sapporo	Understand wider trends in Hokkaido within which Tomakomai developments occur.

251

252 *Table 2: Documentary sources consulted in archives.*

253

254 Using the Prior (2003) methodology for documentary analysis of understanding both the
 255 content of the document itself and also the wider social context within which it was produced,
 256 documents were both sampled and analysed. This involved looking for material and extracts
 257 within them that helped to explain the changing relationship in Tomakomai between the
 258 community, industrial infrastructure and the sea, based on themes raised in the interviews or
 259 in the existing marine social science research reviewed in Section 2. Indicative extracts or
 260 quotes from the sampled documents were noted, and where appropriate are cited in Section 5
 261 to support or evidence the points being made.

262

263 5. Findings

264

265 5.1. Overall citizen and stakeholder response to the Tomakomai CCS project

266

267 On the whole, the interviews and documentary analysis suggest a generally neutral stance
 268 towards the CCS project within Tomakomai, and also Hokkaido and Japan more widely. At
 269 the very least, no strong or vocal opposition to CCS activities in Hokkaido was encountered,

270 and key stakeholders¹ indicated the community understood the nature and rationale of the
271 project. Likewise, regional- and national-level NGOs expressed a neutral stance towards the
272 Tomakomai project and to CCS as a system². The reasons for this are evaluated in more depth
273 in Section 5.2.

274

275 It is worth noting, however, the significance of fisheries to Tomakomai, and thus the
276 importance of the views of fisheries cooperatives on the CCS project. Fisheries are very
277 important socially, culturally and economically across all of Japan (e.g. Makino and Matsuda,
278 2005), hence fisheries cooperatives hold much political sway as to whether projects are able
279 to proceed. Interviewed fisheries cooperative managers in Tomakomai understood the need
280 for CCS as a climate change mitigation technology, noting that ocean acidification and
281 environmental changes attributable to climate change have potential to affect fish stocks in
282 Hokkaido waters and thus that mitigating actions are necessary³. However, there was also
283 concern among fishers over the potential effect from any leakage of stored CO₂. This concern
284 can be understood if one looks at the history of Tomakomai, as documented in sampled
285 archive material. Links between pulp discharges from the Oji Paper factory in Tomakomai
286 and the die-off of fish stocks were investigated earlier in the 20th Century (Hokkaido
287 Government Fisheries Research Station, 1953), with compensation issues being negotiated for
288 several decades (Tomakomai Minpo, 1974; Horie, 1982). Dumping of mud and sand from the
289 excavation of the Tomakomai west port extension in the 1970s (to allow larger ships to berth
290 for petrochemical import and export) was alleged to have had negative effects on the Sakhalin
291 Surf Clam population of Tomakomai Bay (Tomakomai Minpo, 1970). Large-scale

1

e.g. interviews with project operator, Tokyo, June 2014; municipal government industrial location promotion division, Tomakomai, May 2016; Tomakomai port authority, Tomakomai, May 2016.

² e.g. interviews with national climate change NGO, Tokyo, April 2016; regional development organisation, Sapporo, May 2016.

³ Interview with fisheries cooperative, Tomakomai, May 2016.

292 infrastructure developments in east Tomakomai City in the late 1960s and early 1970s (for
293 instance port expansion, construction of a coal-fired power plant, construction of aluminium
294 works) sparked organised protests in the city from fishers (Horie, 1982). Fishers in
295 Tomakomai hence have previous experience with development and industrial pollution caused
296 by other users of the sea, which is viewed as having negatively affected fisheries to the benefit
297 of other sectors. This historical context was explicitly cited by interviewed fishers as grounds
298 for being cautious about - if not opposed to - sub-seabed CO₂ storage⁴.

299

300 In short, community and stakeholder responses towards the Tomakomai CCS project may best
301 be characterised as neutral or cautiously supportive. The social and cultural significance of
302 fisheries in the city, coupled with a historical context of debate over who benefits from
303 industrial development in the sea, does however mean this support is qualified. Equally,
304 though, the fact the project has been able to proceed into the execution stage does indicate
305 operators and decision-makers have had success in balancing the interests of key stakeholders.
306 The article now assesses in more depth how the conditions for this support may have
307 emerged.

308

309 5.2. Why has the Tomakomai project progressed this far without any significant social
310 acceptance issues?

311

312 Aside from the cautious attitude of the fisheries cooperatives described above, citizens and
313 stakeholders close to Tomakomai appear to be neutral towards the CCS project. This may be
314 due to several reasons. Just as understanding the historical context of the community's
315 relationship with the sea helps to understand present-day cautions, so understanding the

⁴ Interview with fisheries cooperative, Tomakomai, May 2016.

316 historical nature of community relations with industrial operators helps to explain why the
317 CCS project is tolerated.

318

319 First, apart from the more historical concerns around fisheries, Tomakomai City has had
320 generally positive recent experiences with industry and the organisations operating it. Heavy
321 industry first appeared in Tomakomai in the late 1960s as part of regional development plans
322 and was met with citizen concern over potential pollution (e.g. Tomakomai Minpo, 1969). Yet
323 interviewees reported that these initial concerns over the coal power plant, oil storage and oil
324 refinery developed to the east of the city have - at a local level at least - not materialised⁵.

325 Interviewees indicated that since then, the operators of energy-related infrastructure in
326 Tomakomai - many of whom are also involved in the CCS project - have come to be seen as
327 'good and trusted' employers in the city with a long record of conducting operations safely⁶.
328 As such, it may be the case that the 'social licence to operate' (Prno and Slocombe, 2012) that
329 operators of petrochemical activities in Tomakomai have developed over preceding decades
330 has to an extent been carried over to the CCS project, which uses the same physical location
331 as existing petrochemical operations for capture and injection processes. In other words,
332 offshore CCS may be viewed by citizens and key opinion-shapers (e.g. local government) as a
333 continuation of existing oil and gas operations in the sea, which have proceeded safely to date
334 in Tomakomai, as opposed to a completely new activity.

335

336 Second and related, industry has to an extent become a source of pride and identity for
337 Tomakomai and the wider Iburi Region in which it is located. Tomakomai and neighbouring
338 Muroran are described as *kigyoujokamachi* (industrial towns, literally: towns under the castle

⁵ Interview with regional development organisation, Sapporo, May 2016.

⁶ E.g. interviews with project site manager, Tomakomai, August 2014; municipal government industrial location promotion division, Tomakomai, August 2014.

339 of industry)⁷ whose locations have allowed them to develop an identity as coastal industrial
340 towns. There is thus familiarity with and even pride in industrial operations in and around the
341 sea, as evidenced by the inclusion of the Oji Paper factory's red-and-white cooling tower in
342 promotional material produced by Tomakomai City (2015). Nevertheless, with regional
343 industries such as steel manufacturing, shipping and paper manufacturing facing challenges,
344 CCS and offshore CO₂ storage may come to be understood as a way of sustaining the city's
345 identity as a coastal industrial town into the future⁸, and indeed in building regional pride by
346 positioning Tomakomai as a national leader in climate change mitigation technology⁹.

347

348 A third driver in building support for CCS operations is trust in local (i.e. municipal)
349 government. This appears especially crucial in gaining and sustaining consent from fisheries.
350 Tomakomai City Government, in particular the Industrial Location Promotion Division, plays
351 a major role in raising citizen awareness of CCS through provision of injection and
352 monitoring data at the entrance of the City Hall. Local government officials and scientists
353 from research institutions involved in seabed monitoring around the storage site (e.g. the
354 Marine Ecology Research Institute) are well-known to fishers, explaining the progress of CO₂
355 storage operations through regular face-to-face meetings at the fisheries cooperative offices¹⁰.
356 Interviewed fisheries cooperative managers likewise spoke positively about the work that key
357 figures within the Industrial Location Promotion Division had undertaken to engage with
358 them around the CCS project, seeing the character and interpersonal skills of these local
359 government staff as a particular strength¹¹. Consistent with social science research conducted
360 in other coastal contexts (e.g. McKechnie, 1996; Mabon and Kawabe, 2017), the fact that

⁷ Interview with port authority, Muroran, May 2016.

⁸ Interview with port authority, Tomakomai, May 2016.

⁹ e.g. interviews with project operator, Tokyo, June 2014; municipal government industrial location promotion division, Tomakomai, May 2016; port authority, Tomakomai, May 2016.

¹⁰ Interview with fisheries cooperative, Tomakomai, May 2016; municipal government industrial location promotion division, Tomakomai, May 2016.

¹¹ Interview with fisheries cooperative, Tomakomai, May 2016.

361 municipal government officials live and work within the community, and hence themselves
362 bear any potential risks from developments, may mean they come to be seen as reliable and
363 trustworthy sources of information for citizens and stakeholders to reach their own informed
364 decision on a proposed development.

365

366 A fourth driver for CCS support in Tomakomai may be the area's wider context of low-carbon
367 energy development, and emerging awareness of the effects of climate change on Hokkaido.
368 Tomakomai and the surrounding area have seen significant developments of mega-solar, and
369 more recently biomass and hydrogen fuel trials¹². It is hence possible that there is already
370 experience of 'new' low-carbon energy technologies appearing around the city. Likewise,
371 interviewees noted increasing prominence of climate issues in Hokkaido such as differences
372 in weather patterns¹³, changes in marine wildlife¹⁴ and the development of prefectural
373 government policy and citizen education initiatives¹⁵. All of this means that the Tomakomai
374 CCS project comes against a much bigger backdrop of low-carbon energy deployment - and
375 emerging awareness of the need for climate change mitigation - in the area. In turn, it may be
376 that CCS is viewed as just one part of this 'bigger picture' of reducing the impacts of climate
377 change on a coastal environment rather than as something separate and distinct.

378

379 Sections 5.1. and 5.2. illustrate that context matters when it comes to understanding the social
380 dynamics of sub-seabed CO₂ storage - and indeed infrastructure issues in coastal regions more
381 widely. The significance of historical context in explaining societal responses to infrastructure
382 is of course not new (e.g. Bickerstaff, 2012; Bradbury, 2012) and is borne out by this
383 Tomakomai data. What may be more challenging, though, is to integrate this rich and context-

¹² Interview with municipal government industrial location promotion division, Tomakomai, May 2016; interview with Hokkaido Government Energy Division, Sapporo, May 2016.

¹³ Interview with regional environmental NGO, Sapporo, May 2016.

¹⁴ Interview with fisheries cooperative, Tomakomai, May 2016.

¹⁵ Interview with Hokkaido Government Climate Change Division, Sapporo, May 2016.

384 specific background into more formalised impact assessment processes. Section 6 reflects on
385 what the implications of these findings may be for coastal social impact assessment processes.

386

387 5.3. Challenges and points of caution

388

389 Whilst the demonstration phase of the Tomakomai CCS project appears to be progressing
390 without major opposition, it is important to draw out socio-political challenges to up-scaling
391 offshore CO₂ storage in Japan which arose from the data. One issue is that whilst local
392 stakeholders and community members are willing to engage with the idea of CCS, national-
393 level opinion shapers may be more cautious. Although interviewed NGOs generally took a
394 neutral stance towards CCS itself, they expressed concern over Japan's plans to increase its
395 fleet of coal-fired power stations, the possible connections between CCS and coal-fired
396 electricity generation, and by extension the climate risks of keeping coal in Japan's energy
397 mix¹⁶. Opposition to further offshore CCS development may thus not come from concerns
398 over techno-scientific risks at the local level, but rather from political concerns at a national
399 scale - especially if CCS is perceived as perpetuating a fossil fuel-based energy system and/or
400 economy.

401

402 Another challenge to draw out is the risk of perpetuating a relationship of dependency
403 between a region and heavy industrial and/or undesirable infrastructure, versus the potential
404 for CCS to act as a bridge to a more sustainable regional future. Tomakomai and southern
405 Hokkaido more widely rely heavily on industry for employment and economic benefit, with
406 neighbouring cities like Muroran and Yubari already feeling the negative effects of a decline

¹⁶ Interview with regional climate change NGO, Maebashi, May 2016; interview with national climate change NGO, Tokyo, May 2016.

407 in steel manufacturing¹⁷ and coal mining¹⁸ respectively. Blowers (1999) argues this reliance
408 can make it hard for policymakers in physically remote and potentially economically
409 marginalised communities of this nature to say 'no' to further industrial developments, hence it
410 could be argued CCS risks perpetuating a relationship of dependency on carbon-intensive
411 industries in already peripheral or marginalised locations. Caution must thus be exercised to
412 ensure that something like the CCS project fits with citizens' views on what a socially
413 sustainable future for Tomakomai City looks like, and to imagine alternative visions of a
414 managed transition which may not rely on heavy industries (the solar power and biomass
415 projects in Tomakomai may be two examples of this). Equally, though, in coastal areas like
416 Tomakomai, it may be possible to frame CCS as part of a managed transition away from a
417 fossil fuel-dependent economy, following 'just transitions' thinking seen in Australia (Evans
418 and Phelan, 2016) and Scotland (Mabon and Littlecott, 2016). CCS may thus gain traction as
419 a framing that allows the economic base of coastal industrial regions in Japan like Tomakomai
420 to avoid a sharp and sudden loss of emission-intensive industries (and associated negative
421 economic effects at the local level) whilst still contributing to climate change mitigation. This
422 may be especially significant to coastal industrial cities in Japan, where the nature of geology
423 and dense population means CO₂ storage will most likely have to be offshore.

424

425 6. Discussion and policy implications

426

427 To conclude, the article reflects on challenges the Tomakomai CCS case raises for
428 undertaking SIA in coastal regions. Five points are identified where the lessons learned from
429 the social dynamics of the Tomakomai project may build, nuance or reinforce Vanclay's
430 (2012) principles for SIA in coastal management. These are intended to draw developers',

¹⁷ Interview with port authority, Muroran, May 2016.

¹⁸ Interview with city planner, Yubari, May 2016.

431 municipal government and national regulators and policymakers' attention to dimensions
432 which may require particular attention when undertaking coastal SIA or developing SIA
433 requirements within marine policy frameworks.

434

435 First, Vanclay (2012: 152) indicates “environmental (biophysical) impacts only occur when
436 the first sod of soil is turned; social impacts occur the moment there is speculation or rumour
437 that something will change”. However, the Tomakomai CCS project demonstrates it may be
438 challenging to identify 'new' social impacts when the project is an extension or development
439 of existing activity in an area. Whilst sub-seabed CO₂ storage is novel to Tomakomai and
440 Japan, many of the companies who have a role operating the project have been refining
441 petrochemicals and transporting oil by sea for several decades. As such, the social dimensions
442 of CO₂ storage are inevitably connected to the economic benefits, social trust and cultural
443 change arising from existing oil and gas operations in Tomakomai. The challenge this raises
444 for those undertaking SIA in other contexts is to pay cognisance to which social impacts may
445 be a continuation of existing activities, versus which are a direct result of new phases of a
446 development. Moreover, in situations where a new phases of development such as CO₂
447 storage may give rise to new perceived risks, there may be a need for regulators to ensure
448 operators undertake sufficient communication and engagement to ensure communities are
449 aware of how a new phase of a development may differ from what has happened previously.
450 This is especially important in a marine context where new activities may not be immediately
451 visible or detectable to citizens or peripheral stakeholders.

452

453 Second, Vanclay (2012: 152) holds that “(p)rocess is everything. It is important to realise that
454 the level and effectiveness of community engagement has a huge bearing on the amount of
455 fear and anxiety experienced.” This is important and has been undertaken for Tomakomai too

456 (e.g. Tanaka, 2014; Okajima, 2016), and reflects current thinking on offshore CCS (Mabon et
457 al, 2015) and other marine infrastructure situations (Gray et al, 2005). Nevertheless, the
458 Tomakomai CCS project demonstrates the importance of effective engagement into the
459 operations phase. SIA processes may appear front-loaded towards getting a project accepted -
460 for instance, five of seven steps in the International Association for Impact Assessment
461 guidelines on SIA (IAIA, 2015) refer to the pre-operation phase. Yet in Tomakomai, regular
462 face-to-face engagement with fishers by research institutions and local government officials to
463 discuss monitoring results and requirements has been crucial in retaining support of a key
464 stakeholder group and public opinion-shaper *after* CO₂ injection has commenced as well as
465 consultation beforehand. The important lesson here for both operators and policymakers is to
466 exercise caution to avoid inadvertently focusing on pre-operation community engagement,
467 and to realise that sustained community and stakeholder engagement during the operation
468 phase may be key to mitigating or avoiding longer-term social impacts. A marine context
469 places particular limitations on what can be sampled and how often (due to need for boats,
470 monitoring equipment, skills etc) and hence on what can be known with certainty. This makes
471 rigorous monitoring and engagement to understand and explain uncertainty all the more
472 important in sustaining societal support in a coastal or marine SIA context.

473

474 Third, Vanclay (2012: 153) advocates a “(f)ocus on what counts, not on what can be counted.”
475 Again, the Tomakomai experience supports this assertion. More than an economically
476 significant activity, fishing for surf clams in Tomakomai is also a source of pride, identity and
477 historical meaning to the city. In other words, the 'value' and meaning of fisheries to
478 Tomakomai - and thus what is perceived as being at risk from sub-seabed CO₂ storage -
479 extends far beyond the economic contribution of fisheries to the city. However, it is also true
480 that in the absence of formalised SIA procedures, in contexts such as Japan at least

481 quantifiable processes like EIAs carry much more weight in evaluating the propriety or
482 otherwise of a new development. In cases where the sea and coast - and activities taking place
483 within them - carry significant cultural meaning which cannot so easily be quantified, it may
484 thus be advisable to extend EIA regulations to include a fuller description of the socio-cultural
485 context. Whilst this does not quantify 'what counts', it may at least in the short term ensure
486 these culturally meaningful aspects are included within formalised impact assessments.

487

488 Fourth, Vanclay (2012: 152) explains “(t)he ‘community’ is never homogeneous.” Where
489 marine environments add complexity, however, is in the potential for currents to carry water -
490 and material within it - over long distances. This means that effects from projects may be
491 perceived as having the potential to affect marine environments and activities beyond those
492 spatially adjacent to the development. In Tomakomai, for example, fisheries cooperatives
493 operating elsewhere in the region have a keen interest in CCS project despite not fishing
494 directly around the storage site. The challenge this raises for setting and undertaking coastal
495 SIA is to acknowledge that understandings of 'ownership' of or interest in the sea may
496 transcend traditional geographical boundaries. There may thus be a need to extend community
497 engagement and impact assessment beyond the locality to encompass other coastal
498 communities in the region with an interest in the well-being of the marine environment.

499

500 Fifth and final, Vanclay (2012: 153) observes “(t)he outflows from a site include not only the
501 products but also the waste products and pollution [...] the products can often have
502 downstream social impacts.” CCS - and other low-carbon technologies like it - are
503 challenging in this regard. On one hand, it is true that whilst the Tomakomai CCS project
504 follows rigorous site characterisation and stringent monitoring to ensure injected CO₂ remains
505 stored below the surface, interviewed fishers have legitimate concerns about effects on fish

506 stocks should anything untoward occur. This may be especially pertinent in the Japanese
507 context given the effects a *perception* of marine produce as tainted has had on Fukushima
508 fisheries (Wada et al, 2013). Equally, however, for low-carbon technologies the negative
509 environmental effects - or at least the perception thereof - must be balanced up against the
510 possibility that doing nothing may be the most harmful option of all if it contributes to
511 continued and unabated climate change. Given the vulnerability of coastal communities and
512 seas themselves to acidification, rising sea levels and extreme weather events, policy for SIA
513 in coastal regions may hence wish to develop provision for understanding how new
514 developments can help to mitigate climate change impacts in the local environment.

515

516 7. Conclusion

517

518 The Tomakomai CCS Demonstration Project illustrates that community responses to a coastal
519 infrastructure project may be complex and nuanced, requiring engagement with the social and
520 cultural context to understand more fully. In particular, present-day stakeholder cautions can
521 become more understandable if one considers historical relations with and experiences in the
522 sea. Likewise, community tolerance for a potentially undesirable piece of infrastructure may
523 make sense when one looks at how the relationship between industry, the community and the
524 sea has developed over time, particularly with regard to relations of trust between long-
525 standing operators, the local government and citizens. The key challenge for SIA and other
526 policy instruments, as argued in this paper, is to find ways to incorporate and make visible this
527 rich social context within existing environmental risk governance processes.

528

529

530

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532

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539

540

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547

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753 Challenges for social impact assessment in coastal regions: a case study of the Tomakomai
754 CCS Demonstration Project

755 Supplementary Information – General Interview Schedule

756

757 1. Context and history

758

759 (a) Tell me about your organisation

760 (i) When was it founded?

761 (ii) What is its purpose?

762 (iii) How does it relate to the environment and climate change?

763 (iv) etc

764

765 (b) Tell me about the current social situation of the city (Tomakomai/Muroran/Yubari etc)

766 (i) Employment base?

767 (ii) General economic situation?

768 (iii) Cultural situation/activity?

769

770 (c) Tell me about the history of the city (Tomakomai/Muroran/Yubari etc)

771 (i) How has the economic and employment base changed over time?

772 (ii) How has the city expanded/developed over time?

773 (iii) How do you think society and culture has changed over time in the city?

774

775

776 2. Environment and climate issues

777

778 (a) What environmental issues are you/your organisation facing at the moment?

779 (i) How have things changed in the last 10-20 years?

780 (ii) Are there any issues that are going to become a bigger problem into the future?

781

782 (b) How does climate change fit into these?

783 (i) How has the climate changed in the last 10-20 years?

784 (ii) What effects do you expect to see from now into the future?

785

786 (c) What policies or countermeasures are you/your organisation taking against climate
787 change?

788 (i) Regulations?

789 (ii) Policies?

- 790 (iii) Anything you are especially concerned about?
- 791
- 792
- 793 3. CCS and low-carbon energy infrastructure
- 794
- 795 (a) Tell me what you know about CCS?
- 796
- 797 (b) Based on what you know, what benefits do you think CCS could bring:
- 798 (i) To your organisation;
- 799 (ii) To this region (e.g. hotels, income etc)?
- 800 (iii) To Japan in general?
- 801
- 802 (c) What other energy or large infrastructure projects are going on in the area just now?
- 803 (i) How do you think these might affect your organisation?
- 804 (ii) How do you think the community feels about them? Why?
- 805 (ii) Do you know if anything is planned for the near future?