ORIGINAL ARTICLE

Journal Section

Plant Siting as Risk: Reframing Community Responses through Risk Communication

Tuomas Raivio[1*] | **Author A. Two MD**[2*] | **Author Three PhD**[2†] | **Author B. Four**[2]

[1]Department, Institution, City, State or Province, Postal Code, Country

[2]Department, Institution, City, State or Province, Postal Code, Country

Correspondence
Author One PhD, Department, Institution, City, State or Province, Postal Code, Country
Email: correspondingauthor@email.com

Present address
[†]Department, Institution, City, State or Province, Postal Code, Country

Funding information
TBD

Green Transition represents a global shift from environmentally and climatically harmful practices toward sustainable activities. Although the global benefits of this transformation are evident, its implementation requires the physical location of new industrial facilities, which can become an inherent local challenge. Gaining a social license to operate hinges on local community approval, and when this approval is lacking, the entire siting process can fail. In this paper, we posit that local communities often perceive the location of Green Transition-related plants as a risk in itself. Therefore, theories of risk communication provide a valuable lens for understanding siting failures and developing effective strategies for early-phase communication aimed at building local acceptance. We explore how risk communication theory can help explain the dynamics of trust, legitimacy, and conflict in contested green transition infrastructure projects. By comparing two Finnish siting cases, the paper investigates how different stakeholders perceive and react to siting-related risks, and how communication practices influence the evolution of legitimacy over time. Finally, we propose a proactive communication strategy to

Abbreviations: ABC, a black cat; DEF, doesn't ever fret; GHI, goes home immediately.

[*]Equally contributing authors.

support the smooth siting of a national hydrogen grid, expected to be realized in the 2030s. .

KEYWORDS
keyword 1, *keyword 2*, keyword 3, keyword 4, keyword 5, keyword 6, keyword 7

1 | INTRODUCTION

Green Transition includes the adoption of renewable energy sources, the implementation of energy-efficient technologies, and the promotion of sustainable consumption and production patterns. Kannan et al. (2022) provide an extensive literature review, and for case studies in Europe, see Nauvelaers et al. (2022). Green transition also drives the growth of green industries (e.g. Santos et al.2), creating new employment opportunities while necessitating workforce reskilling. However, the transition presents challenges, such as potential job displacement in carbon-intensive industries and the need for equitable policy frameworks to ensure a just transition (see e.g. Ciplet and Harrison, 2019, Upham et al. 2022).

From a land-use perspective, the green transition often involves repurposing agricultural or undeveloped land for large-scale renewable energy projects, including solar farms, wind turbines, hydrogen electrolysis, Power-to-X production, bioproduction, battery value chain production; sometimes even data centers and small-scale nuclear reactors are included. A common characteristic of these projects is their large size and volume, their impact on local areas and ecosystems, and their potential hazardous properties. One might argue that the benefits of the projects tend to be certain and global, but the drawbacks are uncertain and local. While these initiatives contribute to reducing greenhouse gas emissions, they can also lead to land-use conflicts, particularly affecting local ecosystems and communities (Koelman et al. 2023, Froese and Schilling 2019, de Jong et al. 2021, Flint 2023, Elomina and Živojinović, 2023 and Kiesecker et al 2024).

In this paper, we argue that the siting of *any* green transition plant represents a risk to local stakeholders that can be perceived as huge. Therefore, frameworks of risk perception and communication offer valuable explanations for land use conflicts and help to make sense of stakeholder reactions, and methods and guidelines of risk communication can be applied to mitigate perceived risks and support the acceptance of siting projects.

A common concept in siting and site operation is Social License to Operate (SLO) (Joyce and Thompson, 2000). SLO literature offers valuable insights into *what* institutional actors must achieve to gain community acceptance, usually legitimacy, credibility, and trust. Understanding the siting through risk communication offers a psychologically grounded framework that explains *how* trust is formed, *how* negative perceptions dominate, and *how* information processing is disrupted under stress. By integrating this model into the context of green transition plant siting, this paper connects the normative goals of SLO theory with practical, phase-specific communication strategies—thus bridging in its part the gap between high-level acceptance theory and on-the-ground implementation.

We begin the paper by outlining a sequential model for green transition plant siting, identifying key stakeholders and their respective interests. We then briefly introduce relevant acceptance theories, with the focus on the concept of SLO. We then introduce the risk communication model of Covello (2021). The role of media and social media is also addressed.

Next, we present two case examples of difficult green transition plant sitings and analyze their trajectories through Covello's theory. Before concluding, we synthesize our findings by examining the soon-starting siting of a national

hydrogen grid.

2 | GREEN TRANSITION PLANT SITING

2.1 | Siting Process and Stakeholders

In this paper, we define a Green Transition Plant (GTP) as an industrial facility that exhibits some or all of the characteristics of a green transition: It provides global benefits in the form of, e.g., climate change mitigation or circular economy, but may have local effects due to its size, scale, or environmental impacts. Usually, but not necessarily, it also carries some hazards, like hydrogen treatment, storing of sustainable fuels, or solar panel fire.

Siting refers to a process where a company selects a location for a GTP within a defined geographical area. For clarity and without significant loss of generality, we refer to this area as a Municipality - an administrative unit with democratic governance and the authority to regulate land use within its jurisdiction.

In a siting process of a GTP, numerous stakeholders interact in complex ways, each with distinct roles and interests. Table 1 presents the stakeholders and their roles. The objectives of the stakeholders are different and partly conflicting. Taken together, the diversity of the stakeholders illustrate the complexity of siting processes, where economic, environmental, regulatory, and social considerations must be carefully balanced. As we will later see, also the concept of risk among stakeholders, and how it is perceived, varies.

Table 1. the stakeholders and their roles in GTP siting. Here, *Approach angle* refers to the way stakeholders are engaged in the project, what the risks are and how they are treated.

2.2 | The Process

We distinguish between five phases that describe the essential steps of the siting of a GTP. From the life cycle perspective of a site, also building, using and decommissioning could be included, but from the siting and conflict perspective they are less important.

1. Status Quo: A Municipality Before Siting Begins

Before any official siting discussions take place, the Municipality continues its routine activities, implementing previously agreed development goals and managing its economic and social priorities. However, local leadership and economic development bodies are often already exploring opportunities within the green transition, assessing potential investments and siting options behind the scenes.

While life seems normal, the stakeholders are never fully isolated from external influences. For example, media and social media continuously shape public perceptions through past GTP siting conflicts. Hence, the status quo is not necessarily stable in any way.

2. Land Use Changes: The First Official Step

In many municipalities of declining industrial interest, land use planning has been moving towards services; areas that had earlier been reserved for industry have been changed into service purposes. However, the Green Transition has woken up the municipalities, and now industrial scale areas are reserved proactively for GTPs. This often involves changes to general and detailed zoning plans. Land-use planning is a complex, participatory process where strong stakeholder input is required. This phase is often the first time when the stakeholders understand that something is about to happen. In some cases, a land-use change is combined with latter steps 3 or 4 below.

3. Plant in Sight: The Project Becomes Public

Siting decisions are often kept confidential until everything is ready. Once the investor formally announces plans

Stakeholder	Role
Investor	Organizes the investment that is to be sited
Industry competitors	May somehow engage in the process, particularly when market dynamics or re
Consultants and constructors	Manage the technical aspects, including design, planning, permitting, and const
Infrastructure companies	Such as electricity transmission and distribution operators contribute by imple
Developers	Actively assist investors in securing suitable sites, particularly for energy-intens
local businesses and supply chains	May benefit from or experience disruptions due to the new Investment
Insurance companies	Assess and mitigate risks associated with the project, influencing design and op
Financial institutions	Critical role in funding of projects, often imposing sustainability and governanc
Landowner	Either rents or sells the property on which the plant is to be located
trade unions and workforce representatives	Focus on labor conditions, fair wages, and the need for reskilling programs.
Municipality	Has the land use monopoly and is responsible for land use planning. offers infr
Government	Supports investments through funding, infrastructure development, and invest
National authorities	Oversee the regulatory framework by granting operational permits and requiri
Residents and local communities	Significantly affected by land use changes, environmental impacts, and econom
Indigenous groups	May have land rights or cultural heritage concerns that necessitate consultatio
Environmental organizations and NGOs	Advocacy for biodiversity, climate, and sustainability concerns, potentially influ
Media and social media	Shape the discourse around the investment, potentially affecting regulatory de

to establish a Green Transition Plant, the siting process suddenly shifts into a highly visible phase. This marks the point where local stakeholders, media, and regulatory bodies begin actively engaging with the project. The interest is often intense and even hype-like. In practice, no real details on local effects are disclosed at this stage.

4. Environmental Impact Assessment (EIA)

In many European countries, an Environmental Impact Assessment (EIA) is a prerequisite for obtaining an Environmental Permit for large-scale GTPs. This requirement is based on the EU EIA Directive 2011/92/EU. In some countries, such as Finland, the EIA process begins with an EIA Programme, which outlines the key environmental aspects to be assessed. In other jurisdictions, the process may begin with a screening or scoping phase conducted by the competent authority.

The EIA Programme is a public document and subject to stakeholder consultation. At this stage, there are typically no definitive answers to the questions and concerns raised in the programme. Often, the publication of the EIA Programme largely sets the tone for the upcoming dialogue.

5. Permitting

In most European countries, large-scale GTP typically require multiple permits before construction and operation can begin. These include, but are not limited to, an Environmental Permit, building or land use permits, and sector-specific authorizations such as water, chemical, or energy-related permits. The permitting procedures are guided by both national legislation and EU directives. While the overall framework is harmonized at the EU level, national variations exist in terms of competent authorities, procedural steps, and integration of permitting processes. In some countries, permitting is tightly integrated with the Environmental Impact Assessment (EIA), whereas in others the EIA serves as a prerequisite but is handled as a separate process. While much of this process is technical, it remains highly sensitive to public opinion and political influence, as the processes and permits can be challenged at administrative courts.

3 | SOCIAL LICENSE TO OPERATE AND RELATED LEGITIMACY THEORIES

3.1 | Social License to Operate

Often, the acceptance of a GTP siting is approached via a suitable theory that posits the goals for the relationship with the stakeholders, especially the local community. One of the prevailing concepts is the Social License to Operate (SLO) that emerged in the early 2000s, originally in the context of mining. An article by Joyce and Thompson (2000) in the *CIM Bulletin* is generally regarded as the first attempt to give the term conceptual substance. The objective was to draw attention to the importance of community acceptance as a condition for continued operations.

Joyce and Thompson (2000) initially proposed that gaining an SLO required being perceived as legitimate. Later, Thompson and Joyce (2008) expanded the model to include credibility and trustworthiness, and suggested that these elements form a cumulative hierarchy. At the lowest level, basic *acceptance* depends on legitimacy; *approval* requires credibility; and the highest level—*psychological identification*—involves trust.

Since then, SLO has become a key concept in mining governance. Boutilier and Thomson (2011) developed tools for assessing and tracking SLO over time. Moffat and Zhang (2014) demonstrated empirically that obtaining formal permits is no longer sufficient for industry actors, highlighting the need to secure social legitimacy through proactive engagement. More recently, SLO has gained traction in other sectors, including energy, infrastructure, and manufacturing. It is now understood not only as a condition for operational continuity, but also as a central concept in early-phase planning, stakeholder engagement, and risk mitigation (see Pasaribu et al., 2021; Barich et al., 2022; Mindanakis and Vega-Araujo, 2024).

Recently, also SLO literature has shown an increasing emphasis on how to obtain legitimacy, too. Wel et al. (2025) posit that legitimacy is socially constructed and not just about procedural norms but also stakeholder perceptions shaped by past experiences. This pushes LTO frameworks to embed historical awareness and dialogic sensitivity into participatory design. Diamastuti et al. (2024) found that obtaining an SLO is influenced heavily by the method of how corporate social response was delivered; interviews, focus groups, and feedback loops were integral in acceptance levels. Onukwulu et al. (2025) states that transparent communication, co-creation, and incentives for stakeholders are pivotal in sustainable initiatives, reinforcing the procedural aspect of gaining legitimacy. Hence, the approach in this paper is complementing this development.

3.2 | Other theories

Closely related to SLO is Legitimacy Theory, which dates to organizational sociology in the 1970s and suggests that organizations seek to ensure their activities align with societal norms (Dowling and Pfeffer, 1975). Some scholars interpret SLO as a contemporary, applied extension of legitimacy theory (Gehman et al., 2017).

Other relevant perspectives include Stakeholder Theory (Freeman, 1984), which emphasizes the responsibility of firms to consider the interests of all affected parties—not just shareholders—and Corporate Social Responsibility (CSR), which focuses on the broader societal obligations of companies (Lindgreen and Swaen, 2010). Resource Dependence Theory explains how organizations adapt to their external environments and manage interdependencies (Barney et al., 2001; Thomson & Boutilier, 2011), while Social Network Theory has been applied to understand how legitimacy and resistance emerge through networked relationships (Wasserman & Faust, 1994).

4 | RISK COMMUNICATION THEORY IN SITING ACCEPTANCE

4.1 | Siting as a Risk for Local Groups

Risk is commonly defined as the possibility of not achieving desired objectives. As was seen earlier, the stakeholders of GTP siting pursue fundamentally different objectives that range from economic returns and regulatory success to the preservation of environmental quality and everyday well-being. As a result, the risks they identify and prioritize diverge significantly.

For companies, risks tend to be professionalized and procedural. Usually they focus on financial viability, regulatory approval, technical feasibility, and reputational management. Risks are typically addressed through established institutional processes and are considered routine elements of project development. Municipalities and the state, on the other hand, weigh economic benefits against potential social and environmental disruptions, treating risks primarily as political in nature. National authorities emphasize regulatory compliance, with primary concerns centered on procedural errors. Environmental organizations focus on risks to ecological integrity, such as biodiversity loss and carbon emissions, often as part of their professional mandate.

For residents, part-time residents, and indigenous groups, the situation is fundamentally different. For these stakeholder groups, *the siting process itself constitutes a risk*, as it is likely to introduce unfamiliar, often irreversible changes to their environment and daily life. Unlike professional stakeholders, who approach siting through systems and procedures, these groups face uncertain and unpredictable changes in their living environment, with unclear consequences for land use, health, safety, cultural heritage, and property values. Furthermore, these groups typically lack access to expert knowledge, receive little institutional support, and rarely have sufficient time to respond. Hence, the asymmetry between groups lies not only in the nature of risks, but also in how they are perceived and in the

capacity of each group to act upon them. This mismatch can often lead to distrust, polarization, and conflict.

When risks are considered, risk communication is a necessity. Given the dynamics above, risk communication is not optional but essential. Unlike general stakeholder engagement or participatory planning, risk communication addresses also the psychological, emotional, and cognitive dimensions of how different groups interpret and react to the same event. Risk communication makes it possible to understand and respond to these asymmetries, not only in terms of what is communicated, but in how messages are received, processed, and acted upon by diverse audiences.

4.2 | Risk Communication and Legitimacy Theories

Participatory planning and stakeholder engagement practices, as well as legitimacy theories such as the SLO, are often grounded in deliberative democratic theory (e.g., Habermas, 1996; Gutmann & Thompson, 2004). These approaches assume that reasoned dialogue, transparent information, and inclusive participation will result in greater legitimacy and improved decision-making. They typically define the desired conditions for acceptance, such as trust, credibility, and procedural fairness (Thomson & Boutilier, 2011), but have tended to remain normative or outcome-focused. As such, they offer limited insight into how legitimacy is constructed, contested, or lost throughout the siting process, particularly under conditions of uncertainty, emotional intensity, or social conflict.

In high-risk or high-conflict siting situations, the ideal of rational consensus may be insufficient. Communicative conditions are often shaped less by formal openness than by affective trust, prior beliefs, and cognitive limitations. Viewing GTP siting through risk communication theory offers an alternative to the rationalist assumptions of deliberative models by highlighting the psychosocial mechanisms at play in high-concern contexts.

While SLO and related frameworks describe *what* must be achieved for public legitimacy, risk communication theory, explains *how* legitimacy is either built or eroded through specific communicative processes. It enables a process-oriented understanding of how stakeholders interpret, resist, or disengage from institutional messaging—particularly under conditions of ambiguity, perceived risk, or historical challenges.

4.3 | Covello's model of risk communication

Originally published in early 2000's Covello's model consists of four factors that determine people's ability and tendency to absorb and judge information under stress (see Covello and Sandman, 2001; Covello, 2003; Covello et al., 2004; Covello, 2021). The fundaments of the model are

1. Trust determination
2. Negative dominance
3. Mental noise
4. Risk perception.

Although the individual components of Covello's risk communication model have been recognized separately for a long time, Covello appears to be the first to synthesize them into a coherent and systematic framework specifically applicable to environmental, technological, and public health risk communication.

1. Trust Determination

Mayer et al. (1995) define organizational trust as "the willingness of a party to be vulnerable to the actions of another party based on the expectation that the other will perform a particular action important to the trustor, irrespective of the ability to monitor or control that other party." Core components of trust are usually summarized

into ability, integrity, and benevolence (Mayer et al., 1995; Schilke et al., 2023). Ability refers to what extent we believe that a party embodies the competences needed to perform its tasks. With integrity, we assess whether a party adheres to acceptable principles and keeps the promises it makes. Benevolence is the extent to which a party is believed to want to do good to the trustor. An important way to manifest benevolence is caring, i.e. expressing empathy, attentiveness, supportiveness and protectiveness (Schoorman et al., 2007).

Another main dissection of trust is the division into cognitive and affective trust (McAllister, 1995). Cognitive trust is based on evidence, logic and track record, while affective trust is based on emotional connection or empathy.

Covello posits that people are more attentive to technical information if it is presented by a trusted source. Trust is built on the perception that the source is caring, emphatetic, competent, honest, open and transparent (Covello, 2021). Only a fraction of trust is based on competence or expertise. Social and cultural factors shape attitudes towards the absorption of information, i.e. what is important and what is not. The same factors also determine the importance attached to a risk or a threat. The presented topics, words, figures and scenarios guide people in their judgment. Hence, gaining and sustaining trust is of utmost importance in all stages of risk communication. Trust is a prerequisite for everything else: only when trust has been established, can other goals be fulfilled.

2. Negative Dominance

It is largely known that people put greater value on losses than on gains (see, e.g., the work of Kahneman and Tversky, 1979). Covello develops this further and postulates that this is especially true for people under stress; stressed people tend to put even more weight on negative information than on positive information. Consequently, negative wording in communications will receive the most attention.

3. Mental Noise

When people perceive a significant threat, they become stressed or agitated, and their ability to process information becomes severely impaired (Kahneman et al. 2021). Furthermore, they tend to experience a range of emotions that creates something that in psychology is known as mental noise. Mental noise refers to the constant stream of internal dialogue, thoughts, worries, and distractions that occupy people's minds. Mental noise can reduce the ability to process information by as much as 80% (Covello, 2021). Besides threats, significant sources of mental noise are denial of an issue, trauma from an issue, competing agenda and emotional arousal *per se*.

4. Risk Perception

Risk perceptions are the subjective judgments people make about the characteristics and severity of a risk. According to the theory of risk perception, risk is not an objective phenomenon perceived in a unique way by all involved. Instead, numerous factors affect the way risk is acknowledged and felt by the people. In his seminal work, Slovic (1987) showed that there are two main dimensions, *Dread* and *Unknown* that explain risk perception. Under *Dread* one usually groups factors like

- Catastrophy potential
- Controllability
- Effects on children and other vulnerable receptors
- Effects on identifiable victims
- Delayed effects
- context (pleasurable/dreaded)
- Media framing and awareness
- Fairness
- Reversibility
- Voluntariness of risk

- Distribution of benefits
- Personal stake
- Trust in people controlling the risk.

Under *Unknown* are typically factors like

- Nature of evidence
- Familiarity with risk
- Understanding/visibility
- Uncertainty.

With the above interpretation of GTP siting as a risk, there are several factors pertaining especially to residents. Even the mere siting of a completely riskless plant, like a solar panel field, is seen potentially as an uncontrollable and catastrophic change that affects all generations, fellow residents, has delayed effects, is dreaded, far from fair and totally irreversible from the human life point of view. Uncertainties are large, residents are unfamiliar with the plants, and nature of evidence is questionable since it usually comes from the stakeholders in group 1, that have an agenda. The siting is happening involuntarily, distribution of benefits is seen completely one-sided, and trust in the people controlling the siting is lacking. Solid evidence of conspiracy is the fact that the project becomes public only when it is already planned. If the plant further has some environmental impacts or real process risks, the reactions will be amplified by many orders of magnitude.

4.4 | Role of Media and Social Media in Risk Communication

Mainstream news media - including television, radio, newspapers, and magazines -have long served as key sources of information about risks and threats. They have played a role in agenda-setting and shaping public discourse, though to a lesser extent than before. Since the advent of the Internet, non-traditional information sources and digital media consumption have significantly disrupted this role, blurring the lines between journalism and content creation. Public trust in mainstream news media has declined markedly in recent years (Gallup, 2024; Reuters Institute, 2024).

The rise of social media platforms has radically transformed the risk communication landscape. These channels have become dominant for both information dissemination and public dialogue (Covello, 2021). Social media has revolutionized not only how people communicate, but also how they seek, share, and validate information, especially in times of uncertainty. Unfortunately, a growing body of evidence shows that the algorithms governing social media content prioritize themes that generate engagement, often by amplifying negativity or misinformation (e.g. Hilbert et al., 2024). These algorithmic choices reinforce emotional content, not necessarily accurate or balanced information.

According to media effects theories, traditional and social media shape understanding through *priming* and *framing*. Priming influences how prior exposure to certain content affects subsequent judgments (see Roskos-Ewoldsen et al. 2002), while framing determines how issues are constructed and interpreted (Druckman, 2001). *Thematic framing* refers to how the issue is embedded in typical larger frameworks, while *episodic framing* tends to highlight a single part of the issue (Iyengar and Kinder, 1987).

GTP siting projects can serve as rich material for emotion-driven narratives that prevail in modern media and spread likely in social media. Emotions elicit stronger responses and are more likely to drive clicks, shares, and discussion. Consequently, negative news performs well—in both mainstream and social media. A logical consequence is that the media coverage of GTP sitings tends to emphasize local negative impacts—such as noise, emissions, or land

use conflicts—over global and local benefits, which are abstract and distant. This negativity bias is further amplified by social media algorithms, which favor affectively loaded content. Together, these dynamics are likely to shape the communication environment in which public perceptions of GTP siting are formed.

5 | CASE ANALYSIS AND SYNTHESIS

5.1 | Methodology

This section outlines the approach used to analyze two particularly challenging GTP siting cases. Reporting of Case 1, a green steel mill, is primarily based on a stakeholder analysis conducted by a mediation consultancy (Näsman et al., 2024), which draws on interviews with residents, elected officials, and other key stakeholders. The author also participated in the process safety assessment of the intended siting. Case 2, involving a battery material factory, is reconstructed from publicly available sources, including national and local media, and collected through systematic media searches (see Appendix 1).

Case 1 was selected because it represents one of the most intense and recent siting conflicts in Finland. It also benefits from timely access to first-hand accounts and documentation via the mediation process. Case 2 was chosen as a comparable recent conflict that has received national attention. While its context differs in some respects, it serves to demonstrate that the core dynamics identified in the analysis are recurring and broadly applicable.

To assess public discourse and media sentiment surrounding both projects, we utilized Meltwater.com (Meltwater, 2025), a media analytics platform that aggregates and analyzes content from online and print media, and direct access to local Facebook groups where Meltwater has no access. The analysis and the results are summarized in Appendix 2 and provide additional context on the dynamics of public perception and media framing in each case.

The analysis follows the five-phase GTP siting framework introduced earlier in the paper, and overlayed with Covello's model to evaluate how trust, negative dominance, mental noise, and risk perception evolved at each phase.

Finally, we present a synthesis exploring the applicability of this analytical approach to the forthcoming national hydrogen grid siting process. It should be noted that the case examples serve as illustrative examples; Due to the nature of the analysis, some subjective components are inevitably present in the analysis. It should also be noted that a complete media analysis would require a different approach. Here, the emphasis is on demonstrating the analysis power of risk communication approach.

5.2 | Case 1: Green Steel Mill Siting

5.2.1 | Timeline of events

In early 2023, a Norwegian startup Blastr Green Steel announced plans to build a green steel mill in Inkoo, a small bilingual municipality of approximately 5,000 inhabitants in Southern Finland. The decision to locate in Finland followed local resistance to similar siting efforts in Northern Norway.

Green steel refers to a steel production method, whereupon the iron ore is reduced with hydrogen instead of carbon. Carbon dioxide emissions of carbon-based reduction are significant, whereas hydrogen-based reduction emissions are minimal, if hydrogen is green and produced, e.g., with renewable electricity in an electrolysis process.

Soon after the initial announcement, the landowner, Finnish state-owned energy company Fortum, publicly disclosed plans to reserve the same site also for green ammonia production. However, due to growing controversy and planning complications, this plan was later abandoned.

The siting area was brownfield; recently, a large coal power plant had been demolished from the area. There had been some disputes on the land use in the area. However, the disputes were very local in their nature and typically concerned noise and dust.

The announcement attracted substantial international and national media attention, and initial local sentiment was largely positive or neutral. The project was widely viewed as a potential economic boost to the municipality. In March 2023, the municipal council formally initiated a land-use planning change to accommodate facilities for the storage and treatment of hazardous chemicals associated with the project.

The conflict began to escalate in August 2023, following the release of the Environmental Impact Assessment (EIA) programme. The EIA launch event was held exclusively in Finnish, despite Inkoo is a majority Swedish-speaking municipality where bilingual communication is the norm. A Swedish-language event was only organized later upon request.

The EIA programme—although still preliminary—triggered significant public concern, particularly regarding the waste heat from hydrogen electrolysis and its potential effects on the sensitive archipelago ecosystem. These concerns were expressed even though actual impact assessments had not yet been conducted.

Simultaneously, the zoning process had encountered difficulties. The original plan to accommodate both a steel mill and an ammonia plant faced intensifying resistance. In late 2023, it was decided that the detailed plan would be revised to allow only the steel factory. This required restarting parts of the zoning process, redoing several assessments, which further delayed the process. Finally, the zoning process and the EIA process unintentionally overlapped.

As of early 2025, the authority has issued a conclusion confirming that the EIA process meets legal requirements. However, the municipality has not yet approved the revised detailed plan, which remains a critical prerequisite for siting. The company is expected to submit its environmental permit application next. Both the planning decision and permit application will likely be contested by stakeholders, suggesting a protracted administrative court process.

5.2.2 | Communication during the phases of siting

During the status quo phase, public communication activity was minimal, which is typical. There were siting preparations going on, but they were not disclosed. There was no public demand for information, and no proactive communication from the project developer or the municipality.

As the project became public, initial communication efforts largely emphasized the positive aspects of the investment, focusing on its alignment with national green transition goals and its potential economic benefits at the local level (see Appendix 2). Social media messaging mirrored the upbeat tone of national and international media coverage. Early concerns primarily focused on the credibility of Blastr Green Steel, which is a startup company. Social media analysis (see Appendix 2) shows that there were barely any comments in the local Facebook group.

Communication challenges intensified significantly during the EIA phase, beginning in August 2023. The publication of the Environmental Impact Assessment programme sparked substantial concern among residents. At this point, communication needs increased markedly. According to Näsman et al. (2024), many residents felt that communication from both the project developer and the municipality was insufficient—both in terms of timing and substance. Public discourse was characterized more by questions, concerns, and speculation than by concrete information or dialogue. Media and social media content analysis (Appendix 2) shows that over time, however, critical comments increased, especially regarding communication, environmental risks, safety, and the project's scale. The aggressive tone of critical commentary led many residents to withdraw from online dialogue altogether (Näsman et al., 2024). As a result, constructive local discussion about the project's potential benefits largely disappeared.

The growing intensity of public criticism also had a chilling effect on political leadership. Elected decision makers

became hesitant to take public positions, and municipal staff adopted a cautious communication stance. In the local Facebook group, only on local politician of the municipality posted from the municipality's side. Other nonnegative postings in social media were scarce.

In early 2024, the municipality launched a strategic visioning process with the local community to foster a shared vision for the municipality's future. While the process was generally welcomed, it did not resolve the immediate communication and trust issues associated with the ongoing siting process.

Blastr itself entered the social media discussion in early 2024; some 15 % of the postings in the local Facebook group came from Blastr. The participation from Blastr in the social media was strictly informative.

5.2.3 | Analysis in the light of Covello's model

According to Näsman et al. (2024) , the essential problem categories in the described process were identified as follows:

1. Environmental impacts
2. Language and cultural change
3. Vitality factors of Inkoo
4. Municipal decision-making
5. Participation opportunities and information needs of residents
6. Credibility of the project developer
7. Role of the state.

Out of these seven categories, only two, 1 and 3, are directly linked into observable and tangible facts on the positive and negative consequences of the siting. The other five are obviously linked to, trust, negative dominance, mental noise, and risk perception.

In the following we analyze the anticipated development of the factors of Covello's model. In the analysis it should be noted that some of these factors, especially mental noise and risk perception, are difficult to measure directly, and therefore we concentrate indirectly on the factors that are likely to alter them, and on the results of the interviews in Näsman et al. (2024).

Trust

In the initial status quo phase, before any public announcement of the project, trust among local residents toward the developer and authorities was likely undefined and untested. With no concrete project in view, no direct expectations had been formed. However, existing societal narratives, such as earlier environmental disputes in Finland, may have served as background priming, shaping latent attitudes toward industrial actors and regulatory bodies. The public announcement phase generated significant media coverage and conveyed an optimistic narrative focused on green transition goals and local economic revitalization. However, despite the positive tone, trust did seem to change - residents did not get any further evidence on the competence, integrity or benevolence of the decision makers. As the land use change process advanced, gaps in communication became evident. Residents and other stakeholders began to perceive a lack of transparency and inclusion. Key decisions appeared to proceed without extensive public dialogue, which likely affected especially the perceived integrity and benevolence.

In the EIA phase, trust declined rapidly. The formalization of uncertainties—such as the potential environmental impacts of heat load from hydrogen electrolysis—occurred without corresponding efforts to build understanding or provide reassurances in a responsive and inclusive manner. The absence of meaningful interaction contributed to the

formation of adversarial interpretations. By the time the project approached the permitting phase, trust among many opponents had deteriorated to the point where they no longer considered new information from project consultants or authorities credible, regardless of its technical content.

Negative dominance

In the early phases, negative narratives were largely absent from the public domain. The media and project communication emphasized the benefits of the investment, and there were no significant challenges to this framing. However, as procedural complexity increased and concerns about the project's scale and ecological footprint emerged, oppositional framing began to gain visibility.

During the EIA phase, negative messaging became prominent, particularly on social media platforms. Emotionally charged content began to circulate, amplifying concerns about local environmental risks and procedural fairness. As opposition organized and gained traction, these narratives began to displace the earlier focus on benefits. By the time the permitting phase approached, negative dominance had become a defining feature of the communication environment. In this context, efforts by the developer or authorities to correct misperceptions or provide clarifying information were often reinterpreted through a critical lens.

Mental noise

The anticipated level of mental noise, i.e., the cognitive difficulty experienced by individuals attempting to process risk-related information, was likely low during the early phases. Public awareness was limited, and the project had not yet introduced complex or unfamiliar content. As the land use change was initiated, mental noise likely began to increase. Residents encountered unfamiliar planning procedures and legal terminology, often without accessible explanatory material or opportunities for clarification.

The EIA phase introduced substantial technical content related to chemical risks, emissions, and environmental impacts. These were presented in a formal, document-driven manner with limited opportunities for contextual framing, first in wrong language only. This coincided with increasing online debate, often involving conflicting information. Under such conditions, mental noise likely intensified, which impaired the public's capacity to distinguish between credible sources and interpret technical evidence. By the time the project reached the permitting stage, this condition had become entrenched, contributing to widespread disengagement or resistance.

Risk Perception

In the beginning of siting, risk perception was irrelevant, as no project had yet been proposed. With the public announcement, perceived risk seemed to remain low; the framing emphasized climate benefits and job creation. However, once land use changes and the EIA process began to introduce the physical implications of the plant, including hazardous substances and emissions, the perception of risk obviously started to escalate.

The escalation was not, however, solely linked to assessed hazards. In the EIA phase, the perception of risk grew rapidly and was likely fueled by uncertainty, the lack of meaningful dialogue, mental noise, and the perception that residents had little influence over the process. Risk was likely no longer understood in environmental terms but extended to concerns about institutional integrity and community well-being. These perceptions persisted as the permitting phase approached, with risk now framed by some stakeholders as unacceptable regardless of regulatory thresholds or mitigation strategies.

Table2 summarizes the anticipated evolution of key factors in Covello's risk communication model as well as media and social media contents across the phases of the siting conflict (see Appendix 2).

Table 2. An assessment of the factors of Covello's model and media contents in different phases of siting.

Phase of siting/ Components of Covello's model	Media and social media, observed in media analysis
Status quo -2023	Neutral
Publicizing – early 2023	Positive
Land use change - early 2024	Neutral
EIA (2024-2025)	Examples of framing and priming can be found, social media commenting
Permitting (in near future)	To be seen

5.3 | Case 2: Siting of a pCAM Factory

5.3.1 | Timeline of events

In early 2020s, Finland set ambitious targets to expand its domestic battery value chain. The strategy involved co-investment and developing advanced battery material production. As part of this effort, it was announced in 2021 that Finnish Minerals Group, a state-owned holding company, would, in partnership with Chinese battery materials company CNGR, invest in a precursor cathode active material (pCAM) factory in Hamina, a small city in Southern Finland with a major seaport.

Precursor cathode active material (pCAM) is a powder-like substance used as the intermediate product in the production of cathode active material (CAM) for lithium-ion batteries. In pCAM synthesis, metals are extracted from metal sulfates, and the residual sulfate ion is typically paired with an abundant metal such as sodium. The resulting by-product, sodium sulfate, has low commercial value and is often treated as waste and discharged.

In 2020—prior to the formation of the joint venture—Finnish Minerals Group's project company initiated an environmental impact assessment (EIA) covering four potential locations across Finland. Because the EIA programme was general in nature and noncommittal regarding siting, it did not generate significant public attention. Later, the EIA process was divided into two separate programmes: one covering other locations and another focusing specifically on Hamina. The updated Hamina-specific EIA programme was presented digitally due to the COVID-19 pandemic. Over 60 questions were submitted by more than one hundred participants. The final EIA report was approved in mid-2021.

Land use changes were initiated in parallel with the EIA to support the necessary zoning adjustments. Since the proposed site was already designated for industrial use, only minor changes to the zoning plan were required.

In early 2022, the joint venture company CNGR Finland Oy was officially established. After further engineering and planning work, CNGR Finland Oy submitted an environmental permit application for the plant in early 2023. The application was made public in the spring of that year. The publication of the permit application prompted an unprecedented volume of feedback. During the official comment period, 489 public remarks were submitted—reportedly a national record for an industrial permitting process. Many of the comments came from residents, environmental NGOs, and fishery stakeholders, with concerns centered on the proposal to discharge treated wastewater—containing high concentrations of sulfate—into the Gulf of Finland. The overwhelming sentiment was that the plant should be required to remove or significantly reduce sulfate from its effluent, rather than rely on dilution in the sea.

In response to the criticism, CNGR Finland revised its wastewater treatment plan during the summer of 2023. Notably, the company enhanced its effluent handling strategy by adding a diffuser system and considering a change to the discharge location to improve mixing and reduce environmental impacts.

Due to the changes in effluent design, the authorities took the unusual step of re-publishing the permit notice in November 2023 to allow the public to review the updated application. The discharge location was slightly adjusted,

and additional water quality modeling was submitted for regulatory review. This step demonstrated a high level of regulatory diligence and transparency.

In early 2024, the environmental permit was granted. The permit imposed strict limits on several chemical emissions but did not require the removal of sulfate from the effluent. The authorities concluded that sulfate discharges would not constitute a significant environmental hazard, primarily due to anticipated dilution in the sea.

The sulfate issue triggered a strong public backlash. Environmental organizations and concerned citizens mobilized against the decision. A social media campaign and petition gained rapid traction. On the legal front, 12 formal appeals were submitted during the spring of 2024. Appellants included national and regional environmental NGOs, local fishery associations, and nearby property owners.

In April 2025, CNGR announced its withdrawal from the project, citing challenging market conditions and global overcapacity in the battery materials sector.

5.3.2 | Communication during the phases of siting

During the status quo phase, planning for the project took place largely behind closed doors, as usual. Communication was minimal and confined to internal discussions and sporadic mentions in business media. The City of Hamina was quietly involved in attracting the investment, but no public consultations or local meetings were organized—at this stage, the project remained a possibility rather than a certainty.

Media coverage was scant, and the few early reports framed the initiative in optimistic terms, emphasizing Finland's ambition to build a domestic battery value chain and CNGR's potential role in it. However, this coverage barely registered locally. From CNGR, Finnish Minerals Group (FMG), municipal officials, and regulators, there was effectively silence—a neutral tone that preserved public unawareness.

During the land use change phase, the main communicator was the City of Hamina, primarily through official notices and council decisions. Although the land-use planning process was legally public, it attracted little citizen participation or controversy. No public events or media campaigns were launched to inform residents about the zoning changes. Communication was procedural and administrative—such as the posting of planning documents and council agendas—and likely went unnoticed by many residents. FMG's press releases framed site selection as part of a proactive national strategy. The City of Hamina emphasized the project's economic potential, but again, communication occurred mostly through formal channels, rather than public-facing media or interactive events. This set an optimistic tone among institutional stakeholders, but because messages remained within administrative boundaries, many locals may not have realized that a large-scale chemical factory was being planned nearby. Dialogue at this point was limited to institutional actors—city planners, FMG, and CNGR—and did not extend to the public.

The public announcement phase marked a significant shift in visibility. Once the joint venture and investment plans were formally revealed, the tone of communication became highly positive and forward-looking. Key actors emphasized economic growth, job creation, and Finland's strategic position in the green transition. Hamina's mayor publicly welcomed the project, noting that industrial jobs would be especially important for the region.

Traditional media echoed this framing, reporting on the investment value, expected employment (around 150 direct jobs), and alignment with climate goals. At this stage, social media activity remained limited and largely neutral. With the project framed as an economic and technological opportunity, few residents raised concerns, and the public narrative remained favorable.

During the EIA phase, CNGR and FMG maintained a technical and factual communication style. Thousands of pages of documentation were made available, and project updates were published on company websites. Public engagement was conducted primarily through statutory channels: consultation rounds, digital hearings, and submission

of feedback. While some residents and stakeholders participated—submitting questions or comments—the company's communication remained largely one-way and expert-driven.

The City of Hamina's role during this phase was mainly administrative. It worked to ensure zoning and planning alignment with the EIA outcomes but did not lead any public-facing communication efforts. As a result, while the EIA was legally transparent, it failed to generate widespread public understanding or support.

The permitting phase brought the most intense communication—and the most dramatic shift in tone. Armed with an approved EIA, CNGR Finland Oy submitted its environmental and water permit applications. As the process progressed, the company ramped up outreach efforts. CNGR Finland organized Q&A sessions for residents, participated in city-hosted events, and distributed information through brochures and its website. These communications emphasized technical safeguards—such as advanced wastewater treatment, air emission controls, and environmental monitoring. Despite these efforts, this phase was marked by high public distrust and vocal opposition. Social media activity intensified, and national media began to highlight the conflict. The project, previously framed as a sustainable investment, now appeared to many as an environmental risk.

5.3.3 | Analysis from risk communication point of view

Case Study 2 largely follows the same pattern observed in Case Study 1. Trust, negative dominance, mental noise, and risk perception did not evolve independently; rather, their interaction shaped how the project was understood, contested, and ultimately discontinued.

Trust

At the outset of the project, trust among residents toward the developer and authorities was likely undefined and untested. Planning was initially conducted through a proxy organization (Finnish Battery Chemicals Oy), and public communication remained minimal. While the industrial location may have reduced initial concern, no structured effort was made to build relational or cognitive trust in the early phase. The lack of early engagement meant that the local community remained unaware and uninvolved, possibly creating a foundation for later mistrust.

The first major deterioration of trust occurred during the digital presentation of the Environmental Impact Assessment (EIA) programme. The digital format was limited in interactivity and emotional bandwidth. This presentation introduced multiple uncertainties without a framework for interpreting them in a relatable or reassuring manner. Such communication constraints may have undermined confidence in both the project and the institutions involved.

Trust declined further during the permitting process. Although the developer provided additional information and arranged public events, these actions did not effectively address public concerns. As skepticism grew, trust in the neutrality of the permitting authority and the municipal administration also appeared to diminish. At this stage, trust was no longer recoverable through conventional communication strategies.

Negative Dominance

In the early stages of communication, positive framing dominated: the project was linked to national battery strategy, green industrialization, and employment potential. However, as attention shifted toward environmental risks—particularly the discharge of sulfate into the Gulf of Finland—critical interpretations began to gain salience. The interpretations included concerns about marine impacts, regulatory credibility, and perceived inconsistencies in state policy.

As these concerns gained visibility, particularly on social media, they displaced more neutral or supportive narratives. Stakeholder communications from the developer were often interpreted in adversarial terms. Over time, critical narratives became dominant in both traditional and online media, while supportive voices became less visible. In other words, adverse messages received more attention and retention than positive ones.

Phase of siting/ Components of Covello's model	Media and social media, observed in media analysis	Trust, likely lev
Status quo	Neutral	Labile, unknow
Publicizing	Positive	Labile, unknow
Land use change	Neutral	Labile, unknow
EIA	Social media commenting intense, negative dominance	Eroded rapidly
Permitting	Social media commenting intense, negative dominance	Nearly nonexis

Mental Noise

During the initial stages of the project, public cognitive load concerning the siting remained low. However, the digital EIA event marked a shift: multiple technical uncertainties were disclosed in a setting that limited explanatory interaction. This likely increased individual difficulty in interpreting the material and assessing its relevance.

In subsequent phases, communication volume increased, but consistency and clarity did not. Residents were exposed to a mix of expert statements, administrative decisions, activist content, and user-generated social media posts. This created a saturated information environment. Mental noise likely impaired individuals' ability to process new information, particularly under conditions of low trust.

Risk Perception

Initially, the perceived risks of siting were low. The location, an established industrial area, may have contributed to the sense that the project posed minimal disruption. However, as the environmental content of the project became more concrete, and particularly after the publication of the permit application, perceived risk increased significantly.

The planned discharge of wastewater with high sulfate content became a central focus of concern. Public interpretations of the environmental and symbolic implications of this discharge extended beyond the technical framing offered in official documentation. These concerns were reinforced by comparison to earlier environmental controversies in Finland and internationally. Risk perception in this context expanded to include institutional risk (i.e., loss of regulatory integrity), ecological harm, and threats to local identity.

In line with Covello's model, perceived risk increased even in the absence of new hazard data, due to reduced trust, increased mental noise, and the dominance of negative messaging. Opponents likely felt that the risk is more and more unknown, unvoluntary, irrecoverable and affects future generations – all classical examples of factors contributing to risk perception.

By early 2025, all four components identified in Covello's model had developed in ways that reduced the possibility of continued public acceptance. The subsequent withdrawal of CNGR from the project—officially attributed to global market conditions - coincided with this deteriorated communicative environment. While not necessarily causally linked, the timing indicates the importance of social license considerations alongside technical and economic factors.

Table 3 summarizes the anticipated evolution of Covello's key risk communication components across the Hamina siting timeline. We see a largely similar pattern as in Inkoo.

Table 3. The anticipated evolution of Covello's key risk communication components across the Hamina siting timeline and media observations.

5.4 | Summary Analysis

The difficulties of the case sitings cannot be adequately explained by technical content or procedural faults alone. Rather, they must at least partially be understood as communication failures embedded in the unfolding of the siting process.

In both cases, the status quo phase was characterized by a lack of proactive trust-building. No strategic communication or social groundwork was laid before the projects became public. The municipalities, being small and resource-constrained, had neither the capacity nor the perceived need to foster trust capital. In the former case, the dismantling of an old coal power plant had likely erased the industrial memory of the site, priming residents to view the new project as an intrusion. Trust, while not yet eroded, was fragile, unmeasured and unanchored. In Covello's terms, the conditions were ideal for negative dominance once risk-related messages emerged.

The publication of siting rapidly triggered opposition in both cases, in the latter case once the municipality had been chosen. The initial public response was neutral, but it shifted quickly to resistance as it became clear that no trust capital existed to interpret or balance the new information. In both cases, project proponents appeared to misread the early silence as acceptance rather than the calm before opposition. Therefore, efforts to acquire and secure social license by ensuring trust began too late.

Even though in Hamina the resistance was channeled to permitting, the EIA process was the tipping point. In the first case, a dense catalogue of uncertainties was first published and presented monolingually in a bilingual area, and in the second case it was published in a short online meeting. Both events likely affected heavily to the benevolence component of trust. Especially the former act was likely perceived as dismissive and disrespectful, intensifying cognitive overload, mental noise, and emotional alienation. Residents, feeling excluded from the planning conversation, began to interpret the EIA as evidence of harm rather than mitigation. The document was later studied with forensic intensity by opponents seeking to block the land use change, illustrating how transparency without empathy can invite scrutiny rather than support.

In Inkoo, land use planning and EIA phases became even unintentionally coupled—a procedural overlap that backfired. As the assessments related to the land use change were not aligned with the EIA report, the discrepancies between the assessments and EIA became a major source of distrust and caused a significant amount of extra work. In the latter case, EIA of the plant and the land use change were coordinated. In the latter case, land use phase as such did not play a big role.

In both projects, social media became a high-speed opinion amplifier of worst-case scenarios, episodic framing, and emotionally potent narratives. In Blastr, a significant share of the resistance came from summer residents—well-networked individuals from urban centers concerned about declining property values. Their feedback dominated public discourse, giving the appearance of local consensus against the project even when broader public sentiment was less clearly defined.

By the permitting phase, both cases were already on a steady trajectory toward an administrative conflict. In both cases, companies were forced to make technological changes in their processes and attempts to explain the situation were taken. Technical compliance could no longer substitute for public legitimacy and loss of trust. Procedural transparency had not been accompanied by emotional engagement, and as a result, permitting was now perceived not as a safeguard, but as a battleground. As a result, several complaints to administrative court were filed in the latter case, and the same can be expected for the steel mill case.

Taken together, the Inkoo and Hamina cases exemplify how each phase of the GTP siting model introduces escalating communicative risks that should have been tackled in a very different way. The earlier these risks are addressed through inclusive, transparent, and culturally aware engagement, the less likely they are to manifest as full-blown op-

position. The failure to communicate meaningfully from the outset virtually guarantees contestation, no matter how technically sound the project may be.

Despite all analysis presented here it is also fair to say that some of the concerns of the local stakeholders, especially in Hamina, may have been justified; one reason for allowing the sulfate discharges in permitting was that there was no Best Available Technology and corresponding maximum wastewater concentration threshold values defined for sulfate discharges. Despite this, a thorough analysis in the EIA supported the fact that effects to the sea would have been tolerable.

5.5 | Cross-Cutting Lessons Learned

Across both cases, several recurring patterns emerge that highlight structural weaknesses in how complex industrial siting processes are communicated and managed. While the projects differ in geography, project actors, and local histories, both exhibit comparable shortcomings—and valuable insights—when examined through the framework of risk communication.

1.Building and Maintaining Trust

1A. Unrealistic expectations, insufficient resourcing

In both cases, the projects were presented as national strategic flagships of the green transition and received considerable political and media visibility. However, the communication efforts and resources allocated to building public trust and social license to operate did not match the scale of these expectations. Developers and municipalities operated with limited capacity for proactive, inclusive, or adaptive engagement. As a result, communication responsibilities fell into gaps between actors, enabling confusion, fragmentation, and ultimately conflict.

1B. Participatory processes are not designed for trust-building

Despite fulfilling formal requirements, statutory procedures—such as zoning consultations, EIA hearings, and permit notifications—failed in building trust. These processes are institutionally optimized for procedural transparency and legal defensibility, not for fostering mutual understanding or legitimacy. In both Inkoo and Hamina, key stages such as EIA programme publication or zoning changes were handled in rigid, one-directional formats. Instead of reinforcing legitimacy, these moments seem to have generated alienation and suspicion.

1C. The narrative must begin already during the status quo

One of the most critical lessons is that communication should not be delayed until plans are finalized. In the early "status quo" phase—when decisions are still open and risks hypothetical—silence leaves the communicative space open to speculation, rumor, or disengagement. In both cases, early-stage communication was minimal or absent, which meant the opportunity to shape expectations and provide orientation was lost. Risk perception begins to form long before the actual assessment of risk is undertaken.

2. Avoiding and Fighting Negative Dominance and Mental Noise

2A. The EIA programme launch is a moment of high sensitivity

The publication of the EIA programme is a pivotal communicative crossing. If handled poorly, it activates public concern rather than address it. In Inkoo, failure to recognize local language norms led to perceived disrespect. In Hamina, the digital-only format likely lacked emotional sensitivity and interactive features. In both cases, uncertainties were introduced without sufficient context, reassurance, or opportunity for dialogue, resulting in elevated mental noise and reduced trust.

2B. Presence matters—especially when the situation becomes contested

One of the most damaging dynamics in both cases seems to have been the retreat of key communication actors precisely when public debate intensified. Municipal leaders became cautious, political representatives avoided visi-

bility, and companies limited their exposure. In Case 1, one municipal decision maker organized most of the positive commenting, but this started too late. While often justified by legal risk or reputational concern, this withdrawal allowed one-sided narratives to dominate public discussion. Communication efforts should remain continuous, accountable, and visible, even under pressure, especially during moments of controversy or uncertainty.

2C. Negative dominance tends to marginalize proponents, which requires active balancing

Once negative dominance arises, it becomes increasingly difficult for proponents to participate constructively. In both cases, public discourse turned emotional, and many individuals who supported or were neutral toward the projects withdrew from discussion. This led to an asymmetrical communication environment, where opposition voices became overrepresented—not necessarily because they were the majority, but because the tone of discussion discouraged open, moderate, or supportive expression. Active facilitation and safe spaces for public dialogue are needed to mitigate this effect.

3.Managing Risk Perception

3A. Reduce the sense of dread and unknown by providing meaningful, contextualized information

Perceived risk is strongly influenced by the degree to which the GTP siting feels dreadful and unknown. To reduce these effects, project management must be transparent, anticipatory, and illustrative. This includes providing realistic visualizations, referencing similar projects elsewhere, clarifying timelines, and demonstrating what is known versus what is still being assessed. Face-to-face engagement where residents can meet project staff, ask questions, and witness the investigatory process helps in convincing that uncertainties are systematically addressed. This not only supports credibility but humanizes the project in the eyes of the community.

3B. If trust is lost, communication must be fundamentally reconfigured

Once trust has deteriorated, conventional communication approaches, such as distributing technical reports or emphasizing regulatory compliance, become useless. In both cases, attempts to clarify or correct information were interpreted with skepticism and, in some cases, as strategic misdirection. Under such conditions, information no longer functions as reassurance. Instead, the communication environment shifts from dialogue to resistance and contestation. Rebuilding trust is complex and time-consuming. It requires not only changes in message content but also in tone, messenger, and channel, and must be accompanied by demonstrated responsiveness to stakeholder concerns.

5.6 | Synthesis: Siting of National Hydrogen Gas Grid

National Hydrogen Gas Grid Plan

Finland is planning a national hydrogen grid as a strategic initiative to advance its clean energy transition, bolster energy security, and position itself as a leader in the European hydrogen economy. This grid, stretching 1,500 km from northern parts of the country to south, offers a viable solution for decarbonizing hard-to-abate industrial sectors, such as steel and chemical manufacturing, where direct electrification is challenging. The national hydrogen grid will enable the distribution of green hydrogen to these industries, supporting Finland's commitment to achieving carbon neutrality by 2035.

Pipeline routes needed to be compatible with Finland's multi-tiered land use planning system. At the regional level, routes are designated in the regional land use plans. Local master plans and detailed zoning must accommodate pipeline corridors. Designated safety zones along the route restrict incompatible land use and ensure operational security. The construction will likely be started by land acquisitions: Easements and rights-of-use agreements will be made. Expropriation will be used if voluntary agreements cannot be reached.

The future hydrogen grid siting and construction will contain exactly the same phases as a GTP siting, but in multiplicity: the process spreads over the whole country, and the numerous land owners have the right to refuse a

deal, in which case a lengthy expropriation process is needed – and very likely reported in social media.

The project has become public, but since the exact routes of the pipelines have not yet been determined, local concerns have not yet risen (cf. case 2 above). For the EIA process, the grid has been divided into 5 national segments. The EIAs in all the segments are about to commence during late 2025.

Synthesis

The GTP siting process tends to follow a compressed timeline of public engagement, where a single investor initiates the process and becomes a visible actor early on. The hydrogen grid, by contrast, is more diffuse in ownership and timing: it is coordinated at national level, lacks a single high-profile investor, and has not yet entered most local publics' awareness. However, this anonymity should not be mistaken for resilience.

As the national hydrogen grid moves from strategic vision to implementation, it is likely to enter the same communication terrain that challenges GTP siting projects. While the GTP siting and the national hydrogen grid differ in visibility and project structure, they are bound together by a shared procedural logic, and by a common vulnerability to contested public perception. Both require land use changes, environmental assessment, permitting, and ultimately, social license to operate. In addition, hydrogen grid is susceptible to failing land use agreements and expropriation processes that usually are avoided at all costs.

Even though the grid may avoid some of the emotional intensity that surrounded the case examples, the risk of controversy remains—particularly if landowners oppose expropriation or if communities view the infrastructure as a burden rather than a benefit.

From a risk communication perspective, the hydrogen grid project has one distinct advantage: time. There is still a window of opportunity to build anticipatory trust through proactive engagement with municipalities, landowners, and the public. The lessons from GTP cases suggest that this time should not be squandered on technical design alone. Instead, early, multilingual, and emotionally attuned communication can help preempt the cognitive and emotional barriers.

In conclusion, hydrogen grid siting is not only a technical or legal challenge; like GTP siting, it is a social and communicative one, too. Learning from recent GTP experiences, national grid planning must be accompanied by equally national-scale trust-building: through transparency, anticipation of concerns, and meaningful participation. The same sequence of siting phases applies—but success depends on what happens between them.

6 | CONCLUSIONS

In the light of this paper it seems evident that a green transition plant siting *per se* is regarded as a risk by the local stakeholders. On one hand, the presented theory of risk communication explains the behavior of the public, and on the other hand, it can be used to synthetize fruitful communication. Risk communication offers one perspective on to achieve Social License to Operate. Covello's model of risk communication identifies four core psychological dimensions—trust determination, negative dominance, mental noise, and risk perception - that influence how stakeholders receive and respond to risk-related information. Each of these dimensions maps directly onto typical points of friction in siting processes, particularly in the context of the five-phase siting model presented in this paper and offers an instructive framework for understanding why trust erodes, opposition grows, and social license to operate is ultimately denied. The case examples and the synthesis presented above demonstrate that the failures in green transition plant siting processes are less about technical or procedural deficiencies and more fundamentally about communication breakdowns, particularly in how perceived risks related to the siting itself are managed and addressed by local stakeholders.

How should one prepare for a Green Transition Plant siting? To start with, it must be understood that silence of the local stakeholders is by no means a sign of approval or consent. In the early phases of siting, trust needs to be measured, and if needed, built actively. Building of trust requires not only competence and integrity but also caring. To counter for the negative priming flowing from different directions, the message that the municipality benefits from the possible sitings needs to be carried through. The analysis also suggests that effective communication strategies for contested sitings should not only comply with regulatory standards but also engage affective and cognitive aspects of public perception. Practical improvements include initiating communication before formal processes begin, ensuring in-person dialogue during key phases such as Environmental Impact Assessment Programme publication, and sustaining institutional visibility during periods of conflict.

In the latter stages of siting, providing information in a format suitable for the audience is utterly important. In this context, it is imperative to remember that administrative process materials as such are not suitable for communications with local stakeholders. Although land use change assessments and EIA reports are intended for these groups, they are often written in a style that does not serve nonexperts - they appear opaque and exclusionary. Regulatory documents also tend to emphasize potential risks—hazards, emissions, traffic, visual impact - while benefits, if mentioned, are abstract and future-oriented. If not balanced appropriately, residents and activists, already primed by media coverage and social media, interpret this information asymmetry as evidence that they are being misled or excluded from meaningful participation. Also failures to respect cultural contexts activate strong emotional and cognitive resistance and contribute to mental noise. In the ideal case, every regulatory document should be checked by communications experts before disclosing them. Summaries, presentation materials and brochures on official materials help people perceive the message. At the same time, however, original materials must be available to avoid suspicions.

Avoiding and suppressing mental noise is crucial. The more mental noise appears, the larger the perceived asymmetries are, and the less facts matter. When mental noise raises, public discourse quickly becomes saturated with open-ended questions, fears, and emotionally salient narratives. In such a climate, rational debate gives way to suspicion, and stakeholders disengage or mobilize in opposition. Factors contributing to mental noise are emotional arousal, information overload, low trust, uncertainty, and perceived lack of control. Building and maintaining trust by engaging people and by offering information in an understandable way are essential. Rumor spread needs to be ceased at all possible means.

A key to measuring trust in the community is to have presence in the local social media. In the latter phases, presence in social media is an absolute must. The presence should not be organized through personal accounts of single workers but by official accounts that are maintained by risk communication and substance matter experts who have fast access to facts. These accounts can be used to balance for negative dominance, and especially to control rumors: caring, true, timely and competent messages quickly dissipate emerging mental noise. As social media continues to evolve as a primary information source, its impact on public risk perception will likely grow.

In conclusion, understanding GTP siting as a risk for residents provides a psychologically grounded and operationally relevant framework for communication in the process of achieving and maintaining SLO. It offers a clear path toward avoiding opposition—not by avoiding conflict, but by respecting the emotional and social logic through which communities interpret risk and legitimacy.

7 | APPENDIX 1: RECONSTRUCTION OF CASE 2

The timeline of events for Case 2 was reconstructed using publicly available sources identified through targeted internet searches, conducted in Finnish using relevant keywords. Key sources included:

- Official materials from the City of Hamina
- Documents and announcements from the Centre for Economic Development, Transport and the Environment (ELY Centre)
- Regulatory filings and decisions by the Regional State Administrative Agency (AVI)
- The Environmental Impact Assessment (EIA) programme and final assessment report
- Press releases and project descriptions published on the investor's website
- Articles from local and national news media.

Together, these materials were used to compile a chronological account of the project's development and public communication trajectory. All sources were reviewed with attention to consistency, relevance, and the timing of publication to ensure the reliability of the reconstructed timeline.

8 | APPENDIX 2: MEDIA AND SENTIMENT ANALYSIS

Sentiment Analysis with Meltwater

Meltwater (www.meltwater.com) is a commercial media intelligence and analytics platform used to monitor, aggregate, and analyze digital content from online news, print media, broadcast sources, and social media. In this study, the system was used to assess the volume and sentiment of media coverage concerning the Inkoo siting case.

Sources that were specified were discussion forums, X, News, Blogs, Facebook (with no entry to private groups), Instagram, commenting, and Youtube. For case 1, keyword-based searches were performed using the terms "Blastr" and "terästehdas" (steel mill, in Finnish). For case 2, keywords "Hamina" and "akkumateriaalitehdas" (battery material plant, in Finnish) were used.

Results were grouped into six-month intervals from January 2023 to April 2025. For case 2, also pre-2023 was included. The platform's AI-powered summary feature was used to generate narrative overviews of the media discourse within each time window. These AI-generated summaries were condensed and reviewed to correct redundancies or clear misinterpretations.

Sentiment Analysis on Facebook

Since Meltwater has no access to private Facebook groups, the author joined local Facebook groups *Puskaradio Inkoo* (case 1) and *Hamina (sensuroimaton)* (case 2), to assess local public sentiment and discourse. The which is intended for community-level discussion on local matters. Posts published between 1 January 2023 (1.1.2021 for Hamina) and 30 April 2025 were searched using the keyword "Blastr" and "akkumateriaalitehdas", respectively.

Each post was categorized based on the type of poster:

- Citizens
- Elected decision-makers
- Local associations or community groups
- Blastr representatives
- Media outlets.

Posts were classified by sentiment into the following categories:

- Supporting – expressing positive attitudes or arguments in favor of the project

Time Interval	Meltwater AI Summary
1.1–30.6.2023 (Publicizing)	19 mentions. Posts introduce the Blastr green steel project in Inkoo, citing its enviro
1.7–31.12.2023 (Land use change)	4 mentions. Focus on municipal decision to initiate land-use change. Some discussio
1.1–30.6.2024 (EIA)	22 mentions. Media reports on growing concerns over environmental impacts and p
1.7–31.12.2024 (EIA)	18 mentions. Coverage emphasizes environmental criticism, dissatisfaction with dec
1.1–30.4.2025 (EIA, Land use change)	9 mentions. Discussion centers on the Joddböle industrial area and investment deba

- Opposing – expressing criticism or arguments against the project
- Informative – sharing factual information without taking a stance
- Neutral – unrelated or without discernible sentiment toward the project

Additionally, each post was qualitatively assessed for communicative tone, categorized as either:

- Affective – emotionally charged or value-laden content
- Informative – factual or explanatory content.

Repostings of media content and other postings were judged based on the tone of the original content.

These classifications were made through subjective judgment by the author, based on content and tone. While not derived from computational sentiment analysis, this qualitative categorization enables insight into the evolving narrative dynamics within the local digital public sphere. It should be noted that this analysis is by no means comprehensive; the intention is to demonstrate the patterns that can be seen in communication in traditional and social media.

Table A1 presents a comparative overview of Meltwater-based media summaries and manually coded observations from the local Facebook group for case 1, and Table A2 presents the results for case 2.

Additional findings:

- It was noted that in both cases the municipality administration did not post anything.
- In Inkoo, one elected decision maker participated in the discussion actively. In Hamina, none.
- In Inkoo, positive postings came mainly from the above mentioned elected decision maker, and the postings started only in 2025.
- In Hamina, many of the opposing posts came from a rather small group of people.
- while most of the opposing Facebook posts in Inkoo were affective in their nature, in Hamina they seemed more fact-based.

Table A1. Comparative overview of Meltwater-based media summaries and manually coded observations from the local Facebook group.

Table A2. Comparative overview of Meltwater-based media summaries and manually coded observations from the local Facebook group for case 2.

Time Interval	Meltwater AI Summary (Condensed)
–2023 *(Publicizing)*	14 mentions. Coverage links energy crisis and war to the demand for battery plants. Kotka a
1.1.–30.6.2023 *(Land use)*	5 mentions. Positive framing of a major battery investment with job creation. China seen as
1.7.–31.12.2023 *(EIA)*	5 mentions. Criticism focused on environmental risks related to the project.
1.1.–30.6.2024 *(Permitting)*	63 mentions. Controversy over wastewater and sulfate discharges; criticism of approval pro
1.7.–31.12.2024 *(EIA, land use)*	9 mentions. Concerns about sulfate pollution and impacts to Baltic Sea.
1.1.–30.4.2025 *(Withdrawal)*	5 mentions. Reports on project cancellation citing financial reasons; some mention activism

9 | REFERENCES

Barney, J. B., Wright, M., & Ketchen, J. (2001). The resource-based view of the firm: Ten years after 1991. *Journal of Management*, **27**, 625–641.

Barich, A. W. Stokłosa, J. Hildebrand, O. Elíasson, T. Medgyes, G. Quinonez, A. C. Casillas, and I. Fernandez (2022). Social License to Operate in Geothermal Energy. *Energies*, 15, 139.

Boutilier, I. Thomson (2011). Social license to operate. *SME Mining Engineering Handbook*, Society for Mining, Metallurgy, and Exploration, 1779–1796.

Boutilier, R. G., and I. Thomson (2011). Modelling and measuring the social license to operate: fruits of a dialogue between theory and practice. *Social Licence*, 1, 1–10.

Boutilier, R. G. (2014). Frequently asked questions about the social licence to operate. *Impact Assessment and Project Appraisal*, 32, 263–272.

Ciplet, D., & Harrison, J. L. (2020). *Transition tensions: mapping conflicts in movements for a just and sustainable transition. Environmental Politics*, **29**(3), 435–456.

Covello, V., and P. Sandman (2001). Risk communication: Evolution and Revolution. In: A. Wolbarst (ed.), *Solutions to an Environment in Peril*, Baltimore, MD: Johns Hopkins University Press, 164–178.

Covello, V., D. von Winterfeldt, and P. Slovic (1986). Communicating scientific information about health and environmental risks: problems and opportunities from a social and behavioral perspective. In: Covello, V. T., Moghissi, A., and Uppulori, V. (eds.), *Uncertainties in Risk Assessment and Risk Management*, New York: Plenum Press, 221–239.

Covello, V. T. (2003). Best practices in public health risk and crisis communication. *Journal of Health Communication*, 8, 5–8.

Covello, V. (2021). Communicating in Risk, Crisis, and High Stress Situations: Evidence-Based Strategies and Practice. *IEEE Press*, *Wiley*.

Diamastuti, E., Romadhon, F., Faizty, N. E., & Maharani, H. (2024). Acceptableness analysis of the implementation of corporate social responsibility programs with social license to operate. *Ekuitas*, *8*(4), 654–670.

Dowling, J., & Pfeffer, J. (1975). *Organizational legitimacy: Social values and organizational behavior.* *Pacific Sociological Review*, **18**(1), 122–136.

Druckman, J. N. (2001). On the limits of framing effects: Who can frame?. *The Journal of Politics*, 63(4), 1041–1066.

Elomina, J., and I. Živojinović (2023). Systematic Literature Review of Land Use Conflicts in Northern Sweden—Lessons Learned and Ways Forward. *Resources*, 13(6), 77.

Flint, A. (2023). Grid Locked: How Land Use Battles Are Hindering the Clean Energy Transition. *Land Lines*, Lincoln Institute of Land Policy.

https://www.lincolninst.edu/publications/articles/2023-06-how-land-use-battles-are-hindering-clean-energy-transition

Freeman, R. E. (1984). *Strategic Management: A Stakeholder Approach.* Pitman.

Froese, R., and J. Schilling (2019). The Nexus of Climate Change, Land Use, and Conflicts. *Current Climate Change Reports*, 5(1), 24–35.

Gallup (2024). Americans' Trust in Media Remains at Record Low.

https://news.gallup.com/poll/651977/americans-trust-media-remains-trend-low.aspx

Gehman, J., L. M. Lefsrud, and S. Fast (2017). Social License to Operate: Legitimacy by Another Name?. *Canadian Public Administration*, 60(2), 293–317.

Gutmann, A., and Thompson, D. (2004). *Why Deliberative Democracy?* Princeton University Press.

Habermas, J. (1996). *Between Facts and Norms: Contributions to a Discourse Theory of Law and Democracy.* MIT Press.

Hilbert, M., Thakur, A., Flores, P. M., Zhang, X., Bhan, J. Y., Bernhard, P., & Ji, F. (2024).

8%–10% of algorithmic recommendations are 'bad', but… An exploratory risk-utility meta-analysis and its regulatory implications. *International Journal of Information Management, 75*, 102743.

Iyengar, S., and Kinder, D. R. (1987). *News That Matters: Television and American Opinion.* University of Chicago Press.

de Jong, L., de Bruin, S., Knoop, J., & van der Veen, A. (2021). *Understanding land-use change conflict: a systematic review of the literature. Journal of Land Use Science*, **16**, 3, 223–239.

Joyce, S., and Thomson, I. (2002). *Earning a social licence to operate: Social acceptability and resource development in Latin America. CIM Bulletin*, **93**, 49–53.

Joyce, S., and I. Thomson (2008). Earning a social licence to operate: Social acceptability and resource development in Latin America. *CIM Bulletin*, 93, 49–53.

Kahneman, D., and Tversky, A. (1979). Prospect Theory: An Analysis of Decision under Risk. *Econometrica*, 47(2), 263–292.

Kahneman, D., Sibony, O., and Sunstein, C. R. (2021). *Noise: A Flaw in Human Judgment.* Harper.

Kannan, D., Shankar, K. M., and Gholipour, P. (2022). Paving the way for a green transition through mitigation of green manufacturing challenges: A systematic literature review. *Journal of Cleaner Production*, 368, 132578.

Kiesecker, J., K. Z. Dropuljic, E. Gündüzyeli, C. J. Kennedy, A. S. M. Lauer, R. B. McKenney, R. Naidoo, C. E. O'Connell, and R. B. Shaw (2024). Land use and Europe's renewable energy transition: identifying low-conflict areas for wind and solar development. *Frontiers in Environmental Science*, 12, 1355508.

Koelman, M., Hartmann, T., and Spit, T. (2023). Land Use Conflicts in the Energy Transition: Dutch Dilemmas. *TeMA - Journal of Land Use, Mobility and Environment*, 11(3), 273–284.

Lindgreen, A., and Swaen, V. (2010). Corporate Social Responsibility. *International Journal of Management Reviews*, 12(1), 1–7.

Mayer, R. C., Davis, J. H., and Schoorman, F. D. (1995). An Integrative Model of Organizational Trust. *Academy of Management Review*, 20(3), 709–734.

McAllister, D. J. (1995). Affect- and cognition-based trust as foundations for interpersonal cooperation in organizations. *Academy of Management Journal*, 38(1), 24–59.

Meltwater (2025). Corporate Website. https://www.meltwater.com

Mindanakis, P., & Vega-Araujo, J. (2024). *Social license to operate in the context of geothermal energy: Lessons from the European Union.* **Energy Research & Social Science**, 107, 103488.

Moffat, K., and Zhang, A. (2014). The paths to social licence to operate: An integrative model explaining community acceptance of mining. *Resources Policy*, 39, 61–70.

Näsman, M., Saarikoski, H., and Tynkkynen, V.-P. (2024). Tilannekartoitus Joddbölen maankäyttöön liittyvistä erimielisyyksistä. *Akordi*. [in Finnish]

https://akordi.fi/wp-content/uploads/2024/11/Tilannekartoitus-Joddbolen-maankayttoon-liittyvista-erimielisyyksista_final.

Onukwulu, E. C., Dienagha, I. N., Digitemie, W. N., Egbumokei, P. I., & Oladipo, O. T. (2025). Enhancing Sustainability through Stakeholder Engagement: Strategies for Effective Circular Economy Practices. *South Asian Journal of Social Studies and Economics*, *22*(1), 135–150.

Pasaribu, S. I., Vanclay, F., and Holzhacker, R. L. (2021). The Governance of Social License to Operate in the Forest Industry in Indonesia. In Holzhacker, R. L. & Tan, W. G. Z. (eds), *Challenges of Governance*, Springer.

Reuters Institute (2024). Digital News Report 2024 – Executive Summary.

https://reutersinstitute.politics.ox.ac.uk/digital-news-report/2024/dnr-executive-summary

Roskos-Ewoldsen, D. R., Roskos-Ewoldsen, B., and Dillman Carpentier, F. R. (2002). Media Priming: A Synthesis. In Bryant, J., and Zillmann, D. (Eds.), *Media Effects: Advances in Theory and Research*, 97–120.

Santos, V. H. de M., Campos, T. L. R., Espuny, M., and de Oliveira, O. J. (2022). Towards a green industry through cleaner production development. *Environmental Science and Pollution Research*, 29, 349–370.

Schilke, O., Powell, A., and Schweitzer, M. E. (2023). Review of experimental research on organizational trust. *Journal of Trust Research*, 13(1), 102–139.

Schoorman, F. D., Mayer, R. C., and Davis, J. H. (2007). An integrative model of organizational trust: Past, present, and future. *Academy of Management Review*, 32(2), 344–354.

Slovic, P. (1987). *Perception of risk.* **Science**, 236(4799), 280–285.

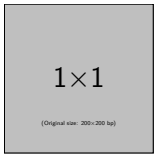
Thomson, I., and Joyce, S. (2008). The social licence to operate: what it is and why it seems so hard to obtain. Presented at: *Prospectors and Developers Association of Canada Annual Conference*, Toronto.

Upham, P., Sovacool, B. K., and Ghosh, B. (2022). Just transitions for industrial decarbonisation: A framework for innovation, participation, and justice. *Renewable and Sustainable Energy Reviews*, 167, 112699.

Wel, K., Mortel, M., Grift, L., & Akerboom, S. (2025). How to make stakeholder participation work? Constructing legitimacy in environmental policymaking. *Journal of Environmental Policy & Planning*, 1–16.

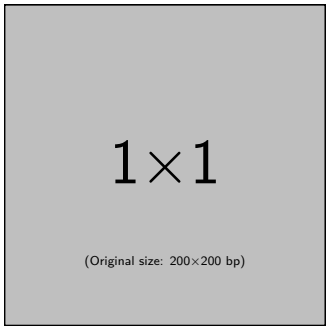
Wasserman, S., and Faust, K. (1994). *Social Network Analysis: Methods and Applications.* Cambridge University Press.

references



A. One Please check with the journal's author guidelines whether author biographies are required. They are usually only included for review-type articles, and typically require photos and brief biographies (up to 75 words) for each author.

GRAPHICAL ABSTRACT



Please check the journal's author guildines for whether a graphical abstract, key points, new findings, or other items are required for display in the Table of Contents.