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Framing Geothermal Energy in Indonesia: A Media Analysis in A Country with Huge Potential

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ABSTRACT

Public perceptions of emergent low-carbon technologies, such as geothermal energy, impact the speed of energy transitions. Such perceptions are largely shaped by how the media portray such technologies. This paper reports on how geothermal energy has been framed in two prominent national newspapers in Indonesia, a country with large geothermal potential due to its volcanic geology. We examined articles on geothermal energy written over ten years. Applying a quantitative framing analysis, we investigated the salience of six frames indicated in the literature as often used in communications on geothermal energy: energy security, economy, legislation, environment, knowledge, and social issues. We also examined the tone and source of the frames. The analysis reveals an overall positive tone in the newspaper articles, especially regarding the technology's energy security and economic potential, with the primary source being the national government. Possible adverse effects of geothermal technology are covered less often, particularly those related to social issues at the local level. We describe the different frames identified, provide examples and discuss implications.

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KEYWORDS
Geothermal energy; Indonesia; energy transition; frame; media; perception

1. Introduction

Geothermal energy is a low-carbon energy source that can help reduce global CO_2 emissions (IRENA, 2021). Due to its volcanic geology, Indonesia is home to 40% of the world's geothermal resources (Mohammadzadeh Bina et al., 2018). Nonetheless, the potential is underutilized, with only about 9% realized (Ekuatorial, 2021). Barriers are technical (Pambudi, 2018), financial (Rayhanna, 2017), and legal (Darma, 2016), as well as public resistance (Candra, 2018).

The resistance is mainly due to negative perceptions fueled by residents' negative experiences (Floresa, 2019; Mardiastuti, 2019). However, those who benefit from geothermal development report positive perceptions (Pambudi et al., 2022). These perceptions can also be shaped by media frames (e.g. Carr-Cornish & Romanach, 2014; De Vries, 2017), which we can see in other fields. For example, negative media frames could result in weak public support of biofuels (Delshad & Raymond, 2013), while positive media frames could associate with public support of nanotechnology (Ho et al., 2010). A Swiss study found that close attention to media and related public

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reactions is essential to minimize future conflicts in geothermal energy development (Stauffacher et al., 2015). Therefore, it is interesting to know how Indonesian media frame geothermal energy.

In general, Indonesian media emphasize the drawbacks of renewable energy implementations (Rochyadi-Reetz et al., 2019; 2020). However, how they frame geothermal energy is yet to be known because empirical data are lacking. This paper provides this knowledge through a quantitative newspaper analysis. Specifically, it seeks answers to three questions: (1) How do Indonesian media frame geothermal energy? (2) Do these frames emphasize the technology's positive or negative aspects? (3) Who is the frame's primary source?

2. Method

We analyzed articles on geothermal energy in two major Indonesian newspapers: *Republika* and *Kompas*. These newspapers appear online and in print and have a high impact and wide readership.[1] *Kompas* has the largest print circulation in Indonesia and Southeast Asia. *Republika* is the only Indonesian newspaper to combine general news with news on Islam, the country's main religion and a crucial influencer of opinions (Nisbet, 2009; Verkerk & Hoogland, 2021).

We took a deductive approach to identify frames (de Vreese, 2005). Using the keywords "geothermal" and "*panas bumi*"[2], we searched for articles published on www.kompas.com and www.republika.co.id between January 2009[3] and December 2019. The search resulted in 352 articles. A sample of 316 remained after removing irrelevant articles: 118 from *Kompas* and 198 from *Republika*. Articles were evaluated as irrelevant because they contain too generic information, are unrelated, and are in-picture articles (see Appendix D).

We followed a three-step procedure for the content analysis (Mayring in Benighaus & Bleicher, 2019). Firstly, we manually coded the articles in Atlas.ti based on the salience of six frames mostly used in the communication of geothermal energy, following Entman's method (1993).[4] The six frames are (1) e*nergy security* (Knoblauch et al., 2019); (2) e*conomy* (Curran, 2012); (3) *legislation* (Shortall et al., 2015); (4) *environment* (Kubota et al., 2013); (5) *knowledge* (Carr-Cornish & Romanach, 2014); and (6) *social issues* (Vargas Payera, 2018).

Secondly, we identified the frame's tone. In line with Gever (2019), we coded stories supporting geothermal energy as positive, unsupportive stories as negative, and disregarded the neutral stories for they do not significantly influence perceptions (Entman, 1993). Thirdly, we identified sources based on the salience of the information in the articles (see Appendix C).

3. Results

In the 316 articles, the six frames occurred 927 times. See Table 1 for their distribution and tone. See Appendix A and B for the detailed arguments.

Energy security is the most prominent frame in Indonesian newspapers. This frame occurred 318 times in the articles. It emphasizes geothermal energy as a reliable energy source for Indonesia. The tone was mostly positive (79% of the 318 energy security frames). The remaining frames mainly reported on the uncertainties surrounding utilization and the pace of infrastructure construction - and not so much on energy security itself. For example:

Table 1. Distribution of Frames.

Frames	*N* = 927	*Positive (%)*	*Negative (%)*
Energy security	318	79	21
Economy	279	70	30
Legislation	143	53	47
Environment	94	67	33
Knowledge	54	72	28
Social	39	41	59

> *The problem is the network coverage from PLN*[5] *to reach the geothermal power points located not too far from the existing geothermal sources … (Republika Online, 23 August 2010).*[6]

The articles also mentioned the *economic* frame quite often (279 times). This frame discusses the funding of geothermal energy development and its economic impact. Seventy percent of the 279 in total discussed the positive contributions to the Indonesian economy. However, around 30% of the frames acknowledged that geothermal development could come with high costs due to uncertainties regarding exploitation.

The *legislation* frame came in third (N = 143) and was evenly positive and negative in tone. For example, a positive frame stated that regulations assure a safe investment climate in the geothermal field. A negative frame focused on regulatory problems, including issues regarding permits.

To our surprise, only a small amount of articles ($N = 94$) reported on the *environmental impact* of geothermal energy. This lack of attention is similar to the Indonesian coverage of other ecological technologies, including biodegradable technology (Yuliarti & Jatimurti, 2019). However, two-thirds of the frames reported the positive impact of geothermal energy on reducing CO_2 emissions and the ability to exploit geothermal resources while maintaining the balance of nature. For example:

> Geothermal technology is safe for the environment because the cycle is closed. The steam water is reinjected, which produces steam and is reinjected again. (Kompas.com, 25 May 2018).

The negative frame mentioned adverse environmental effects. For instance, resource development can affect the local ecosystem, flora, and fauna in the protected forests (see also Kristmannsdóttir & Ármannsson, 2003).

The *knowledge* frame did not appear often, but the majority emphasized the benefits of knowledge and university research centres for reducing uncertainty and disagreement about technology implementation (see Carr-Cornish & Romanach, 2014). The other frames reported on - for example – the negative effects of public misinformation due to a lack of transparency of information.

The *social issues* frame, addressing cultural and social aspects of geothermal energy, was the least mentioned in the articles. And remarkably, unlike the other frames, most were negative in tone.

> At the end of 2017, a group of unknown people who resisted the geothermal project near Gunung Talang burnt the company vehicles (Republika Online, 30 November 2019).

Further findings in this study revealed seven sources, or "owners" of the frames (see Appendix C). The national government was most prominent (40%), followed by the geothermal industry, consisting of state and private enterprises (35%). NGOs and associations owned 8% of the frames with their more sceptical view on geothermal energy development. The regional (6%) and local (4%) governments played a minor role, comparable with the share of scientists (6%) – a surprisingly low proportion considering their roles in geothermal technology development and public education. Local people had the weakest voice, owning just 1% of the frames. Among all sources, they expressed the most significant opposition to geothermal energy development due to the environmental and social effects, including a spiritual relationship with resource sites.

4. Discussion

Our analysis sought to understand how major Indonesian newspapers framed geothermal energy for over ten years. We presented three questions that we will answer below:

First, the most dominant frames are the energy security and economic frames. Geothermal energy is presented as a reliable energy source offering financial opportunities for investment and jobs. These portrayals align with a Swiss media analysis that indicated geothermal energy as essential for a secure energy transition (Stauffacher et al., 2015). Further, social implications, such as cultural issues raised by geothermal development, are underrepresented in the media – which is remarkable because a successful transition of geothermal energy depends largely on the

social context and the support of local communities (Ejderyan et al., 2019). Lastly, the environmental frame plays a limited role. This is also remarkable given geothermal energy's contribution to reducing carbon emissions.

Second, positive frames are dominant over negative frames. This finding contrasts with several other geothermal energy studies that presented predominantly critical perspectives on geothermal energy development (see Dowd et al., 2011; Kunze & Hertel, 2017; Ramírez et al., 2017).

Third, the primary source of the frames were stakeholders who would benefit from the technology, such as the national government and the geothermal industry. The industry was also the most cited source in a Swiss media analysis on geothermal energy (Stauffacher et al., 2015). Local people and critical stakeholders, such as NGOs, received much less media coverage. In contrast to the Swiss study, which reported scientists as the second most cited, we surprisingly found that scientists are minimally cited.

In conclusion, we found that the most influential parties in Indonesia (government and industry) had the most substantial influence on media framing. They mainly emphasize the positive effect of geothermal energy on energy security and the economy. Overwhelmingly positive framing can have two effects. It can increase support for geothermal energy. However, if readers suspect that the information is unbalanced, a boomerang effect can occur. Over time, people can perceive the positive framing of renewables as an attempt to manipulate their views (e.g. De Vries, 2017).

There is no objective standard for determining too much or too little media attention. However, there has been little coverage of social frames, which is important to communities facing local geothermal energy development in Indonesia. This lack of attention to social frames is not without risk. Literature suggests it could escalate resistance as negative perspectives among local people burgeon (Kubota, 2015; Vargas-Payera et al., 2020). Moreover, social media could provide an outlet for criticism, though perhaps more lacking on factual basis. Thus, established media's lack of attention to criticism of the technology could lead to an explosion of attention in alternative media and rising opposition.

Our goal in the current analysis was to gain an impression of media framings of this emerging technology in the national context of Indonesia. However, empirical quantitative and qualitative research (such as surveys and interviews) are needed to gain comprehensive insights into stakeholders' detailed perceptions and frames, including journalists (Nisbet, 2009). Furthermore, newspapers at the regional and local levels might pay greater attention to social aspects and negative local implications of geothermal development since they are closer to communities. A country like New Zealand proved that considering such values is key to successful public engagement in energy transitions (Bargh, 2012).

Investigating other media types is also relevant, mainly social media, radio, and television, as they may present geothermal energy differently. Indeed, many Indonesians rely on social media, such as Facebook, to voice their opinions, as it is accessible and personal (Kusnandar, 2021; Simangunsong, 2021). An integrated analysis of various media types and frame's sources at different levels would provide a more comprehensive overview of Indonesia's geothermal energy portrayal and further fulfil the media's influential role as "social watch" for Indonesia's successful energy transitions (Setyawati & Shaw, 2015).

Authors' statement

The authors certify that they have contributed to all the research actions (e.g. the concept, design, analysis, writing, or manuscript revision). They also have no conflicts of interest to disclose. Furthermore, the authors also certify that this manuscript or similar material has not been submitted or published elsewhere.

Notes

1. According to Statshow of Kompas.com, 2020 and Statshow of Republika.co.id, 2020, based on the page users and viewers, Kompas.com is among the top 200 most popular websites worldwide and Republika.co.id is in

the top 1,000. To add, we refer to the list of Indonesian Newspapers Web Ranking (4IMN, 2019) in which Kompas is at the top, and Republika is at the fourth. Regardless of its position, we chose Republika, for it is the only Indonesian newspaper to combine general news with news on Islam.
2. Indonesian language for "geothermal energy."
3. This year, an influential report for the start of geothermal energy development was published (Ermawati & Negara, 2014; Kasbani, 2009).
4. The data that support the coding procedures are available from the corresponding first author, upon reasonable request.
5. PLN (Perusahaan Listrik Negara, Indonesian State Electricity Company)
6. All direct citations from media were author's translation from Indonesian language.

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Appendices

Appendix A Mapping of frames.

Frames	Set of Arguments	*N* = 927
Energy security	The country needs energy (73), geothermal energy supports the country's needs (46), this technology needs infrastructure (32), and geothermal energy is a potential resource in Indonesia (167)	318
Economy	Cooperation among stakeholders to explore geothermal energy (53), the development provides employment (24), it needs incentive from the government to develop (10), it can increase income (31), it needs investment (102), it needs financial support (6), and price adjustment among stakeholders (53)	279
Legislation	The regulation of legal admission and finance (110), arguments against the law, (6) and other political issues (27)	143
Environment	The resources' locations are situated in protected areas (27), and geothermal energy is environmentally friendly (67)	94
Knowledge	Information dissemination about geothermal energy (24) and research to develop the technology (30)	54
Social	Social issues related to culture (10) and other social arguments (29)	39

Appendix B the tones of the frames.

Energy security frame (N = 318)	
Positive (N = 251)	1. Indonesia has an abundant supply – 40% of world geothermal energy; 2. Geothermal energy is potential renewable energy to support the country's needs; 3. Geothermal energy is local energy that provides regional electricity needs; 4. The industries prioritize a safe working environment for the workers.
Negative (N = 67)	1. Geothermal energy is an uncertain energy resource; 2. The development of geothermal energy is insignificant – less than 10%; 3. The slow pace of infrastructure construction due to the remote location; 4. The exploration location is high-risk – mostly located in volcanic areas.
Economy frame (N = 279)	
Positive (N = 195)	1. The development of geothermal energy can increase state-, regional- and local- revenue; 2. The industries execute specific community development programs to increase the local income; 3. The exploration of geothermal energy can absorb the local workforce; 4. The government promotes the development of the energy by issuing the Subsidiary Loan Agreement; 5. Good cooperation with several foreign investors, e.g. Turkey, Japan, New Zealand, etc.
Negative (N = 84)	1. The exploration of geothermal energy is a high-cost production; 2. The exploration of geothermal energy is a high-risk investment; 3. Incentives and fiscal support from the government are not sufficient to support the development; 4. There is no competitive selling price – PLN (State Electricity Enterprise) is the only buyer allowed.
Legislation frame (N = 143)	
Positive (N = 76)	1. Some regulations related to geothermal energy development are issued, e.g. those related to price adjustment, exploration permits in the protected area, investments, etc.
Negative (N = 67)	1. Management of geothermal energy exploration is centralized, which neglects the authority of local and regional government; 2. Exploration permits in certain protected areas remain difficult to obtain;
Environmental frame (N = 94)	
Positive (N = 63)	1. Geothermal energy is green energy – Less carbon emission is produced; 2. The usage of geothermal energy can reduce the greenhouse effect;

	3. The technology used during production is environment-friendly;
	4. The balance of nature is well maintained during the energy production.
Negative (N = 31)	1. The location of exploration is in a protected area;
	2. Besides the noise pollution, the drilling process will reduce the water supply;
	3. The forest will be barren during the exploration, e.g. to build the infrastructure, and thus, production will reduce the variety of flora and fauna.
Knowledge frame (N = 54)	
Positive (N = 39)	1. The dissemination of information to the public is encouraged;
	2. Collaborative research with foreign scientists has been encouraged;
	3. Research centres for geothermal energy in some universities in Indonesia have been established.
Negative (N = 15)	1. Information assessed by the public is limited and not transparent;
	2. Data availability is not sufficient.
Social frame (N = 39)	
Positive (N = 16)	1. Local people empowerment through community development programs and Corporate Social Responsibility for the affected people are encouraged by the industries;
	2. The project will not disturb the social life of local people;
	3. The industries maintain a good relationship with the neighbourhood;
Negative (N = 23)	1. The project neglects the spiritual relationship between local people and the location of the resources;
	2. There was a gap between local people and the workers regarding social and cultural life.

Appendix C sources of geothermal energy frames.

	Pros		Cons			Total pros		Total cons		Total
Actors	N	%	N	%	Total	N	%	N	%	%
National					*195*	*131*	*27.2*	*64*	*13.3*	***40.5***
The Ministry of Energy and Mineral Resources	69	65.7	36	34.3	105					
DPR (The House of Representatives)	28	70	12	30	40					
President/Vice President	13	65	7	35	20					
The Ministry of Environment and Forestry	8	61.5	5	38.5	13					
The Ministry of Finance	5	83.3	1	16.7	6					
The Ministry of Foreign Affairs	4	100	–	–	4					
The Ministry of Research, Technology and Higher Education	1	33.3	2	66.7	3					
BAPPENAS (State Minister for Chairperson of the National Development Planning Agency)	1	100	–	–	1					
BNPB (National Disaster Management Authority)	1	100	–	–	1					
BPPT (Agency for the Assessment and Application of Technology)	–	–	1	100	1					
Coordinating Ministry for Maritime and Investments	1	100	–	–	1					
Regional					*28*	*18*	*3.7*	*10*	*2.1*	***5.8***
Governor	8	72.7	3	27.3	11					
ESDM	6	85.7	1	14.3	7					
DPRD	0	0	6	100	6					
BP3MD (The Coordinating Board for Regional Capital Investment, Planning and Promotion)	4	100	–	–	4					
Local					*20*	*12*	*2.5*	*8*	*1.7*	***4.2***
Regent	8	61.5	5	38.5	13					
ESDM	4	57.1	3	42.9	7					
Industries					*164*	*123*	*25.5*	*41*	*8.5*	***34***
State-owned enterprises										
PGE - Pertamina Geothermal Energy	50	69.4	22	30.6	72					
PLN (State Electricity Enterprise)	21	72.4	8	27.6	29					
GeoDipa	4	66.7	2	33.3	6					
Private	48	82.6	9	17.4	80					
NGOs and associations	*14*	*38.5*	*22*	*61.5*	*36*	*14*	*2.9*	*22*	*4.6*	***7.5***
Scientists	*17*	*53.1*	*15*	*46.9*	*32*	*17*	*3.5*	*15*	*3.1*	***6.6***
Local people	*1*	*14.3*	*6*	*85.7*	*7*	*1*	*0.2*	*6*	*1.2*	***1.4***
TOTAL					***482***	***316***	***65.6***	***166***	***34.4***	***100***

Appendix D category of irrelevant articles.

Category of irrelevance	Amount	Examples
In-pictures article (A short description article with mainly some pictures content)	7	Series of pictures followed by "A subsidiary of PT Pertamina (Persero) in the field of geothermal energy development, PT Pertamina Geothermal; Energy (PGE) seeks to increase its production by working on various new geothermal development infrastructure from its working area."https://republika.co.id/berita/inpicture/nasional-inpicture/nzek69375/produksi-energi-panas-bumi-pt-pge-area-ulubelu-4
General information of renewable energy	19	"Hadi Purnomo, a Commission 7 Indonesian House Representatives member, wants every stakeholder to discuss renewable energy seriously. He advised the House Representatives and the stakeholders to hold an FGD about renewable energy development. "https://www.republika.co.id/berita/dpr-ri/berita-dpr-ri/17/06/07/or5m87368-dpr-ingin-diskusi-dengan-stakeholder-tentang-energi-baru
Unrelated topic	10	"Mustadi (52), a coffee farmer from Lahat regency, was killed by a tiger in a protected forest area in Rekimai village, between Lahat and Muara Enim regency, Sout Sumatera."https://regional.kompas.com/read/2019/12/14/17430151/disaksikan-istri-petani-kopi-di-lahat-tewas-diterkam-harimau