Case Material for
Sociotechnical Controversies

June 2025

ENERGY ISLANDS

The Issue Atlas

ECHO LAB
The Observatory for Human Centered Engineering

Public Data Lab

erc
European Research Council
Established by the European Commission

DTU

Case material

An atlas made for teaching

The case material is intended as a teaching resource for the analysis of sociotechnical controversies. It is constructed as an issue atlas, a concept derived from Science & Technology Studies, and allows students to follow how concerns are raised by actors over time. Besides this report, which provides background information on the case, explains the methods used, and presents key features of the data, the atlas contains:

- A dataset of actor statements, with metadata, issue classification and semantic analysis, available as both csv and markdown
- A set of Python notebooks for searching, filtering, and visualizing the corpus, available as both ipynb and in Google Colab.
- A set of key case documents available as pdf.

The actor statements were collected in 2025 by students on the Science, Technology & Society Course at the Technical University of Denmark and subsequently curated by researchers from the Observatory of Human-Centered Engineering (**ECHOlab**), who have also designed the Python scripts and enclosed visualizations. The case context and issue classification was developed in collaboration with researchers from the ERC-funded research project **Good-by-devicing: Probing how value comes to matter in the energy transition - the case of energy islands.**

Disclaimer

This case material is for teaching purposes only. It contains paraphrased statements by real-world actors in the controversy around the Danish energy island projects. All paraphrased statements are based on actual statements made directly by the actors, or by others quoting those actors, in publicly available sources. The statements have been translated to English, harmonized to appear as direct first-person utterances that can be understood without further context, and were anonymized if they are not made by an organization or a person speaking in an official capacity. The statements are not intended as research data and should not be quoted as evidence outside the teaching context. The authors of this case material maintain the linked list of original sources for all statements. Since links may break over time, we also maintain the list of verbatim excerpts from the original sources that were used to create the paraphrased actor statements. These excerpts are not made public with the dataset.

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Introduction to the case: The Danish Energy Islands

In the Danish Government's **Climate Agreement for Energy and Industry** of 20th June 2020, a broad political majority decided that two so-called energy islands should be constructed — one artificial island located in the North Sea and the other on the natural island of Bornholm in the Baltic Sea. The **agreement** stated that the North Sea Energy Island was initially expected to deliver 3 GW offshore wind power, with a long-term goal of 10 GW, while the Bornholm Energy Island was projected to produce 2 GW, and later to be upscaled to 3 GW. The offshore wind power hub concept has also been envisioned to be coupled to Power-to-X (PtX/P2X) facilities that use wind power to produce hydrogen (via electrolysis of water) which can then be converted into synthetic green fuels (energy.ec.europa.eu; eur-lex.europa.eu). PtX is currently seen as critical to facilitate sector coupling and decarbonize hard-to-abate sectors such as aviation, shipping and heavy transport, chemical and agricultural industries.

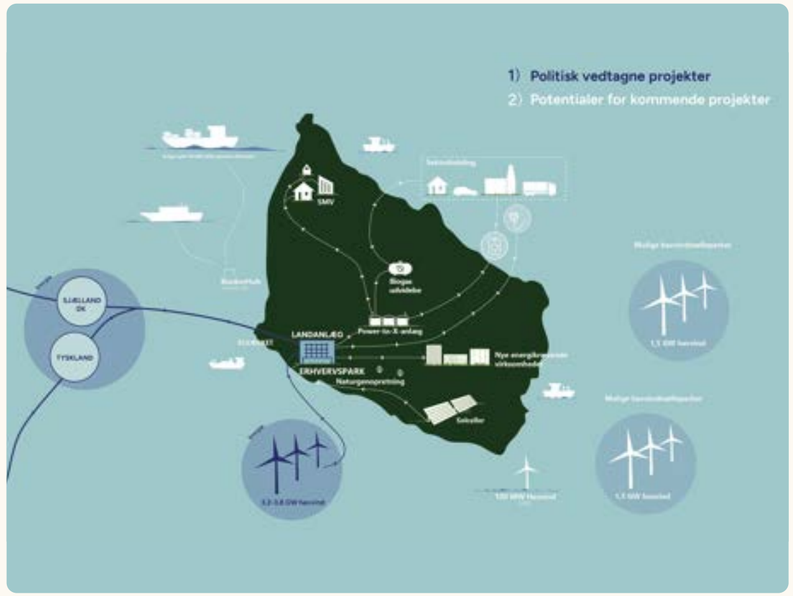
At its core, an Energy Island is **a hub designed to connect adjacent offshore wind farms** and distribute the electricity to surrounding national grids via High Voltage Direct Current (HVDC) transmission lines. Until now, HVDC has been used to connect Denmark to other countries with just bilateral interconnections, the newest and largest being **Viking Link and Cobra Cable.** Developing this type of connection line further, the Energy Islands are envisioned to allow several new features: The Energy Islands are not only able to connect to multiple onshore electricity grids but also to other energy islands in a **hub-and-spoke concept, which is expected to benefit system integration.** This new enhanced interconnectedness opens up opportunities to **harness wind resources at scales previously unattainable.**

As well as providing green electricity to both Danish households and industry, it is a fundamental principle of the concept that the output from the Energy Islands is also exported to other countries and thereby contributes to the green transition in Europe. Energy Island Bornholm's concept design thus includes not only an HVDC connection to Denmark/Sjælland (Zealand) but also to Germany. This connection is a cooperation between the two countries' transmission system operators (TSOs), **Energinet and 50Hertz.** There have also been suggestions of connecting to other countries (e.g. Poland and Sweden), should the concept be expanded.

However, several uncertainties currently jeopardize the construction of the Energy Islands.

A hub-and-spoke system with long-distance transmission to neighboring grids will require extensive HVDC infrastructure and integrating this with the existing alternating current grid will demand **substantial investments, particularly in transmission equipment.**

The original financing plan was that income from the Danish government's tendering of 6GW of offshore wind farms would **help to fund part of the investment needed for the Energy Islands.** However, when the first part of the tendering round closed in early December 2024, **no bids had been received.** This led to the government cancelling the second tendering round in early 2025, and with it the expectation that licensing the right to establish offshore wind energy would produce an income for the government, that could be used for funding the Energy Islands.



The planned Energy Island at Bornholm. Source

A technological challenge to implementing the full HVDC multi-terminal design is that an important component, the HVDC circuit breaker, **is not commercially available in Europe at the scale needed.** In their tender for the onshore equipment on Bornholm, Energinet made this an optional separate tender, so as not to cause unnecessary problems with the procurement of the main equipment.

Some economists have persistently questioned the socio-economic viability of both the **North Sea** Energy Island and **Bornholm Energy Island** project, while **security concerns** have been raised about offshore wind farms, power cables and pipelines in a region that is increasingly becoming a hotspot for **geopolitical tensions.**

At the local level on Bornholm, both the regional **economic development** and **environmental impacts** are being actively debated and assessed. As a local opposition was growing, a number of stakeholders saw a potential of the Energy Islands to facilitate science communication as they represent **"concrete, easy to visualize examples of the energy transition"**. The attempts at local anchoring on Bornholm have been initiated through the public-private fund Baltic Energy Island **partnership** that was established in 2022 with participation from public and private actors, such as the Danish Energy Agency, Technical University of Denmark (DTU), and local municipal actors.

Despite these challenges, the Energy Island concept continues to be viewed as a cornerstone of Denmark's contribution to EU's net-zero CO2 emissions target for 2050. On 30th January 2025, **the European Commission announced an investment of €1,2 billion in cross-border infrastructure,** with the Bornholm Energy Island receiving the largest grant of €645 million, demonstrating European strategic commitment to projects contributing to interconnecting countries and securing energy independency. This idea of a Europe with stronger interconnections offshore is, however, not new. It has been promoted by the work on the so-called **European supergrid** (2008) and discussions over the concept of **SuperSmart Grids** (2009).

In conclusion, both Energy Islands are somewhat in a limbo in writing. While they have been talked about as the 'fantasy islands' amongst some stakeholders, it is today uncertain if they will ever materialize. The North Sea Energy Island was officially put on hold in June 2023, and the Bornholm Energy Island in January 2025. It remains to be seen what will happen to both of them.

High-voltage direct current (HVDC) power hub. Image Source : 50Hertz / Jan Pauls

A conceptualisation of what the Supergrid may look like by Friends of the Supergrid. Image Source

Key documents:

1. COWI, 2023. **Cost Benefit Analyse**.
2. Ministry of Environment and Energy, 1996. **Energi 21.**
3. Kraka Economics, 2023. **Energiø Bornholm - En Økonomisk Katastrofe i Slowmotion**.
4. Kraka Advisory, 2021. **Energiøen i Nordsøen-proces, fakta og risici.**
5. Danish Government, 2020. **Klimaaftale for Energi og Industri.**
6. Energy Island Forum, 2024. **Making Energy Islands a Success.**
7. Ministry of Industry, Business and FInancial Affairs, 2022. **Partnership Agreement.**
8. European Commission, 2025. **Press Release.**
9. Baltic Energy Island, 2025. **Pressemeddelelse, Energiø Bornholm.**
10. DIIS, 2024. **Safeguarding the European Energy Infrastructure.**
11. Danish Ministry of Climate, Energy and Utilities, 2024. **The Esbjerg Declaration. DK,DE,BE,NL**

Timeline

2007
Samsø is self-supplying with renewable energy from offshore wind turbines. They still have a fossil based transportation but aim to be fossil free by the year of 2030. Source

June 2016
TenneT presents hub and spoke concept with this rendering

Source

May 2019
Ørsted announces suggestion for the natural island Bornholm as a test bed island for North Sea Energy Island

Source


Uden fortilfælde: Gigantisk vindmøllepark ud for Bornholm kan blive et grønt gennembrud for Danmark

February 2021
The majority of political parties behind the Danish climate agreement vote in favour of a plan estimating the cost of the North Sea Energy Island to be 210 billion DKK

Source

The number of statments on the controversy increased exponentially from 2016 to 2024

July 2022
Energy Agency delays tenders for North Sea Energy Island

Source

June 2023
North Sea Energy Island project is put on hold

Source

January 2025
Bornholm Energy Island is put on hold, awaiting results of the German Election

Source

Bornholm Energy Island project receives record-breaking €645M as a project of common and mutual interest through the Connecting Europe Facility (CEF)

Source

1996 2016 2017 2018 2019 2020 2021 2022 2023 2024 2025

1997
Samsø wins the title of energy-island over Ærø, Læsø and Thyholm. Source

1996
The strategy plan "Energi21" released by the Environmental and Energy Ministry makes an open call for a "Energy-Island" but only suggests that is should actually be an island, the goal is to transition to 100 % renewable energy. Source

March 2017
Consortium consisting of Energinet, TenneT & 50Hertz is established to work on the North Sea Energy Hub

Source

June 2020
Climate Agreement makes North Sea Energy Island and Bornholm Energy Island official energy policy of Denmark

Source


THE ESBJERG DECLARATION

May 2022
Denmark hosts international climate meeting in Esbjerg where the Esbjerg declaration was signed

Source

February 2023
The open-door policy on offshore wind projects is closed following bids amounting to 15 GW of power

Source

December 2024
The historically biggest bidding round for offshore tenders in Denmark results in zero bids

Source

September 2024
Tender for onshore transformer station on Bornholm. Tender deadline in Sep. 2024 but there has been no public announcement of the results.

Source

February 2025
Denmark's climate council aims to undertake analysis to assess the government's decision to re-introduce state support in tenders for offshore wind parks

Source

Pre-controversy History

Active controversy

A Selection of Key Actors

This section provides an overview of stakeholders that have played a role in shaping the Energy Island controversy. They have been chosen by researchers who are experts on the Energy Island debate. Some actors are prominently represented in the dataset with many public statements on the energy islands. Others have been qualitatively chosen for their importance even though they do not make many public statements about Energy Islands. It is not an exhaustive list.

Lars Aagaard

Minister of climate,
energy and utilities since 2022

Hanne Storm Edlefsen

Director for mega projects, Energinet
(2022- June 2025)

Mette Skøt

Director for Strategic Partnerships,
Bornholm Energy Og Forsyning

Jakob Baruël Poulsen

Managing Partner,
Copenhagen Infrastructure Partners

Nicolaos A. Cutululis

Professor at DTU Wind & Energy Systems
and Chairman of Energy Island Forum

Kåre Møller Madsen

Special advisor,
Danish Energy Agency

Tore Lucht

Business Unit Manager, SWECO in charge of advising the Danish Energy Agency on Energy Island North Sea (2020-2024)

Jacob Østergaard

Professor at DTU Wind & Energy Systems

Peter Haag

Chairman of Bornholms
Havvind

Dan Jørgensen

Minister of Climate, Energy and Utilities (2019-2022). Commissioner in the EU Commission for energy and housing since 2024

Frederik Læssøe Nielsen

Senior economist in Kraka Economics

Søren Møller Christensen

CEO of Baltic Energy Island

Jacob Trøst

Mayor of Bornholm
Municipality since 2022

Transmission system operator (TSO)

Energinet is Denmark's grid operator leading the work on the grid infrastructure for both energy islands, using HVDC to connect offshore wind to domestic and international grids.

Elia Group is the Belgian TSO that is spearheading the Princess Elisabeth Island which stems from the Esbjerg Cooperation's ambitions making it a sister project to the Danish energy islands

Economical Think tank

Kraka Economics is a Danish consultancy firm providing independent economic analysis to support energy transition in Denmark.

Interest groups

Baltic Energy Island is a fund that was established to make the Bornholm offshore energy hub happen thus connecting Baltic Sea wind farms to onshore grids and supporting regional energy integration.

The Energy Island Forum is a partnership that gathers stakeholders from government, industry, and civil society to coordinate and discuss the strategic, regulatory, and cross-border aspects of offshore energy hub development.

Research institution

DTU Wind & Energy Systems is a leading research group at DTU advancing wind energy technologies and integration.

Agencies and regulating bodies

The Danish Energy Agency manages national energy policy and oversees the planning, licensing, and coordination of Denmark's energy islands, including international collaboration.

Bornholm Municipality is the local authority overseeing spatial planning, permits, and community engagement for the Bornholm Energy Island project.

Local utility

Bornholms Energi & Forsyning (BEOF) is the local utility driving Bornholm's green transition and supporting the Danish energy island with renewable energy solutions.

Key industry actors

CIP is a Danish investment firm focused on renewable energy, actively developing offshore wind projects tied to energy island initiatives.

Ørsted is a Danish renewable energy company and the world's leading developer of offshore wind, driving the global transition to green energy where the state holds a majority in the company.

State and agency advisors

SWECO is a European engineering consultancy providing planning and design solutions, including the Danish energy island.

COWI is a Danish engineering firm offering consultancy and technical expertise in offshore energy and large-scale infrastructure for the energy island project.

Citizen groups

Borgerforeningen Energiø Bornholm is a citizen-led group on Bornholm advocating for transparency, environmental care, and public involvement in the energy island's development.

Bornholms Havvind is a citizen-driven and -owned offshore wind project developing a 100 MW wind farm off of Bornholm's East coast to supply local renewable energy and export surplus power.

European energy actors

Connecting Europe Facility Energy is a funding program from the EU Commission to implement Trans-European Networks for Energy Policy.

The North Sea Wind Power Hub Programme is a consortium of European grid and energy operators developing offshore hubs to integrate large-scale wind power across North Sea countries.

The Technology of Energy Hubs

The future for renewable energy production and transmission

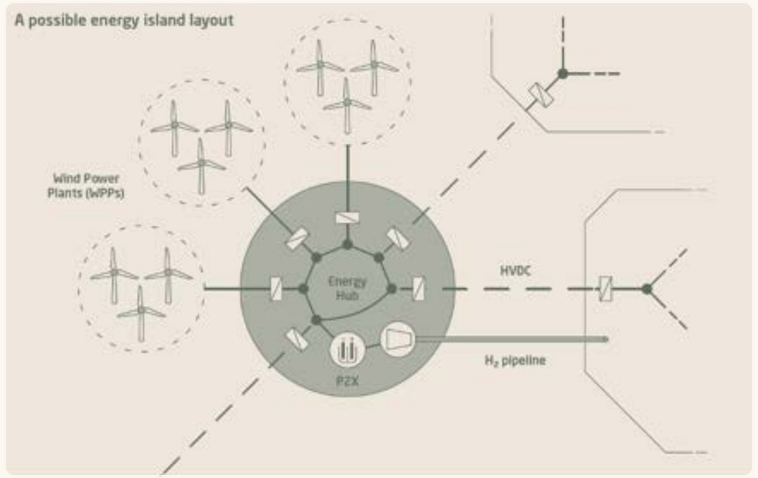
Energy hub:

A geographically located system where production, conversion, storage and/or consumption of multiple energy-carriers (primarily electric energy in this case) is carried out and are characterized by some degree of local control. [1]

In order to meet the European targets for renewable energy in our energy system, there will need to be a massive upscaling in generation from renewable energy, and much of this will need to come from offshore wind energy, some of it much further away in the sea than is the situation currently. This, in turn, means that massive amounts of electrical energy will need to be sent from where they are produced to where they are consumed. Both the connection of offshore wind and its transportation are not possible with today's alternating current (AC) system without large losses of energy.

The proposed solution is to make new connections using direct current (DC) and at high voltage (HVDC). This means far less energy is lost in transportation and there are no reactive power challenges to handle either. HVDC connections have been around since the 1970s but really only for connecting one country to another, where there is a need to keep two systems frequencies decoupled and transport high power over a long distance. Simulations now show that if these country interconnections can be combined with offshore hubs, then the utility of the interconnection cable (the amount of time it is being used for transferring power) is increased, and there is a more efficient use of the interconnector [2].

The offshore hub concept has also given rise to the possibility that some of the electrical energy collected could be used to produce hydrogen, through Power-2-X electrolysis. A possible layout of this is shown below.



Source: [3] "Denmark as the Energy Island Pioneer" (2023)

The figure shows two countries' systems being connected via the energy hub using HVDC interconnectors. The possibility then presents itself of also connecting energy hubs to each other, and/or further countries in a system that has been called an "offshore HVDC meshed grid". This completes the concept of being able to collect and transfer massive amounts of energy over a low-loss DC grid.

[1] Cutululis, N. A., Blaabjerg, F., Østergaard, J., Bak, C. L., Anderson, M., da Silva, F. M. F., ... & Jørgensen, B. H. (2021). The Energy Islands: A Mars Mission for the Energy system.

[2] Alavirad, S., Mohammadi, S., Golombok, M., & Haans, K. (2021). Interconnection and generation from a North Sea power hub–A linear electricity model. International Journal of Electrical Power & Energy Systems, 133, 107132., https://doi.org/10.1016/j.ijepes.2021.107132.

[3] Østergaard, J., Christensen, E. D., Halsnæs, K., Riisager-Simonsen, C., Lisbjerg, D., Jensen, A. D., ... & Uhd, L. A. (2023). Denmark as the Energy Island Pioneer. https://orbit.dtu.dk/en/publications/denmark-as-the-energy-island-pioneer.

The challenges:

A high power HVDC grid is technically a very different system than the AC grid we have at the moment. Whilst the critical components of such a grid (devices such as power converters, in particular Voltage Source converters, and DC cables) have been around for some time, putting them together in a grid (and not just in a point-to-point connection between countries) is challenging:

A DC-based system has no universal time signal (i.e. frequency oscillation of voltage) that an AC system has. This presents challenges of co-ordination and control.

- A DC-based system has no universal time signal (i.e. frequency oscillation of voltage) that an AC system has. This presents challenges of co-ordination and control.
- An AC-based system coupled with traditional thermal power stations that have large rotating masses (i.e. generator rotors), has an innate amount of system inertia, that through the frequency, can balance power generation and consumption. A DC system based on power converters has no such inertia. Control and communication thus becomes a much more critical feature of DC systems.
- AC generators have an in-built tolerance to system faults, i.e. they can survive a high fault current for a relatively long period. DC power converters are, in contrast, sensitive to even low multiples of rated current, and thus handling system faults and making DC systems operate safely is also challenging.
- In any electrical system, breakers – devices that can electrically disconnect parts of a system by opening a switch at full load (i.e. "breaking" the current) – are vital for both system protection and personal safety. In an AC system, the sine wave nature of the alternating voltage means that there is a "zero-passing" point, i.e. a point in time where the voltage passes through 0V. This provides an opportune moment to open the switch (or breaker) with a minimum of arcing between the contacts and effective operation. In a DC system there is no such 'zero point'. This therefore has to be artificially created by a vast dissipation of energy in an extremely short period of time. This manner of high power DC breaker is an essential component but the technology is only in its infancy

As maybe now can be appreciated, energy hubs as part of a meshed HVDC grid of the future hold the promise of being able to handle the vast amounts of renewable energy our society is foreseen to need, but also present some challenges in creating an electrical system that requires both different components and control from what we are used to, but also a different set of electrical engineering philosophy and skills.

Actor Statement Dataset

The dataset of actor statements was collected from open online sources by students and researchers at DTU between January and May 2025.

The statements span a period from 1998 to 2005, which respectively marks the start of the public conversation on energy islands in Denmark and the moment when the Bornholm Energy Island project was officially put on hold in February 2025.

Each actor statement is classified according to the following typology:

id - Which statement is it.

The unique identification number of each statement to find it between the 6832 rows

Statement - what was said.

The piece of text that belongs to a specific actor. All statements have been translated to english and paraphrased as first person utterances.

Actor - who said it.

The name of the person or entity who made the statement. If the person is publicly known or a spokesperson, their full name is displayed. If they are a private person, company, or interest group, they are named as such respectively."

Representative of - on behalf of whom.

The company, organization, interest group or media outlet that an actor statement represents the position of.

Context - what is their role.

The description of the rank, job title or position of an actor in the organization or company they represent. Identifying the role an actor plays in the organization they are representative of.

Year and Date of Publication - when it was published online.

The date and the year when the data source was published.

Source URL, Source name, Source type - where has it been said.

The source type identifies the medium or format that a statement was found in.

Issue (1 to 16) - what is the statement about.

The issue within the controversy ascribed to the statement. The problem that the argument pertains to.

X & Y - where is this statement located in the map.

The coordinates that locate the statement in the visualization.

A	B	C	D	E	F	G	H	I	J	K	L
id	Statement	Actor	Representative of	Actor context	Year	Date of publication	Source URL	Source name	Source type	Cluster	Issue_1
0	Bornholm will become Denmark's thi With the new bidding zone on Bornh This will not significantly impact elect	Hanne Storm	Energinet	Vice President, E	2024	2023-02-20	https://dk.li	LinkedIn	Social media	(None)	FALSE
2	No Danish companies develop or ma	LinkedIn user	General public opinion		2024	2024-12-30	https://ww	LinkedIn	Social media	(None)	FALSE

AA	AB	AC	AD
Issue_16	X	Y	Size
FALSE	451.4339	-964.5698	3
FALSE	-47.6076	708.1746	3.418605

Methodology

1. *Collect Actor Statements*

The corpus of actor statements was collected from open online sources by students and researchers at DTU between January and May 2025

SYSTEMATIC WEB SEARCH

We designed a set of Google queries that allowed us to systematically harvest text mentioning the term "energy island" in a Danish context across different media outlets, parliamentary debates, social media, scientific publications, stakeholder websites, reports, and other open online sources.

RETRIEVE ACTORS AND ACTOR STATEMENTS

We identified actors expressing opinions about the energy islands in the harvested text. We then paraphrased that information as direct first person utterances by the actors in question which can be understood without additional context and translated it to English. This was done in an iterative process, cleaning for duplicates and anonymizing private citizens not speaking in an official capacity, using a combination of computational and manual approaches.

BUILD THE DATASET

For each statement we note the actor who is speaking, the organization on behalf of which the actor is speaking (if applicable), the role of the actor in that organization at the moment of speaking (if applicable), as well as the time, medium, type of medium, and source url from which the statement was retrieved.

DATASET OF 6061 ACTOR STATEMENTS

2. *Issue Discovery*

To discover how the actor statements address different issues related to the energy islands, we took **two different approaches**. A bottom-up semantic analysis focussing on detecting and interpreting clusters of similar statements, and a top-down, expert-driven approach aiming to classify the statements according to a predefined set of issues.

BOTTOM-UP SEMANTIC ANALYSIS

1) ***Embedding***: *locate all the actor statements in a multidimensional semantic space using an embedding model.*

2) ***Clustering***: *find groups of semantically similar actor statements.*

3) ***Annotation***: *qualitative summarization of the theme in the 15 largest groups of semantically similar statements.*

4) ***Reduction***: *for visualization purposes, all statements receive an X and Y coordinate in two dimensions according to their semantic similarity*

DATASET WITH CLUSTER NAMES AND SEMANTIC EMBEDDING

The associated python scripts allow you to explore the map and discover differences and similarities between actor statements. They also allow you to filter the map based on largest clusters of semantically similar actor statements, i.e. bottom-up discovered topics.

EXPERT-DRIVEN ISSUE CLASSIFICATION

1) Issue dictionary: work with experts on the energy island controversy to define 16 issues that they assess to be central.

2) Classification: use a large language model to classify each actor statement according to whether they address each of the issues.

3) Validation: Conduct an interrater reliability experiment to assess agreement between humans and the LLM on the classification

DATASET CLASSIFIED BY ISSUES

The associated python scripts allow you to filter the dataset by issue and explore which actors are more active, when, on what media types, where on the semantic basemap, etc. In the following pages we use this feature to filter the map by different issues.

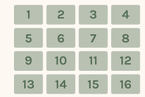
3. *Visualisation*

On the following pages we provide a baseline of visualizations. The associated python scripts allow you to customize your own.

Below you can see an overview of the different types of visualizations.

ANNOTATED SEMANTIC BASEMAP

The basemap shows the location of all actor statements based on their semantic similarity in two dimensions. The topics found through qualitative bottom-up analysis of the largest clusters are annotated on top.



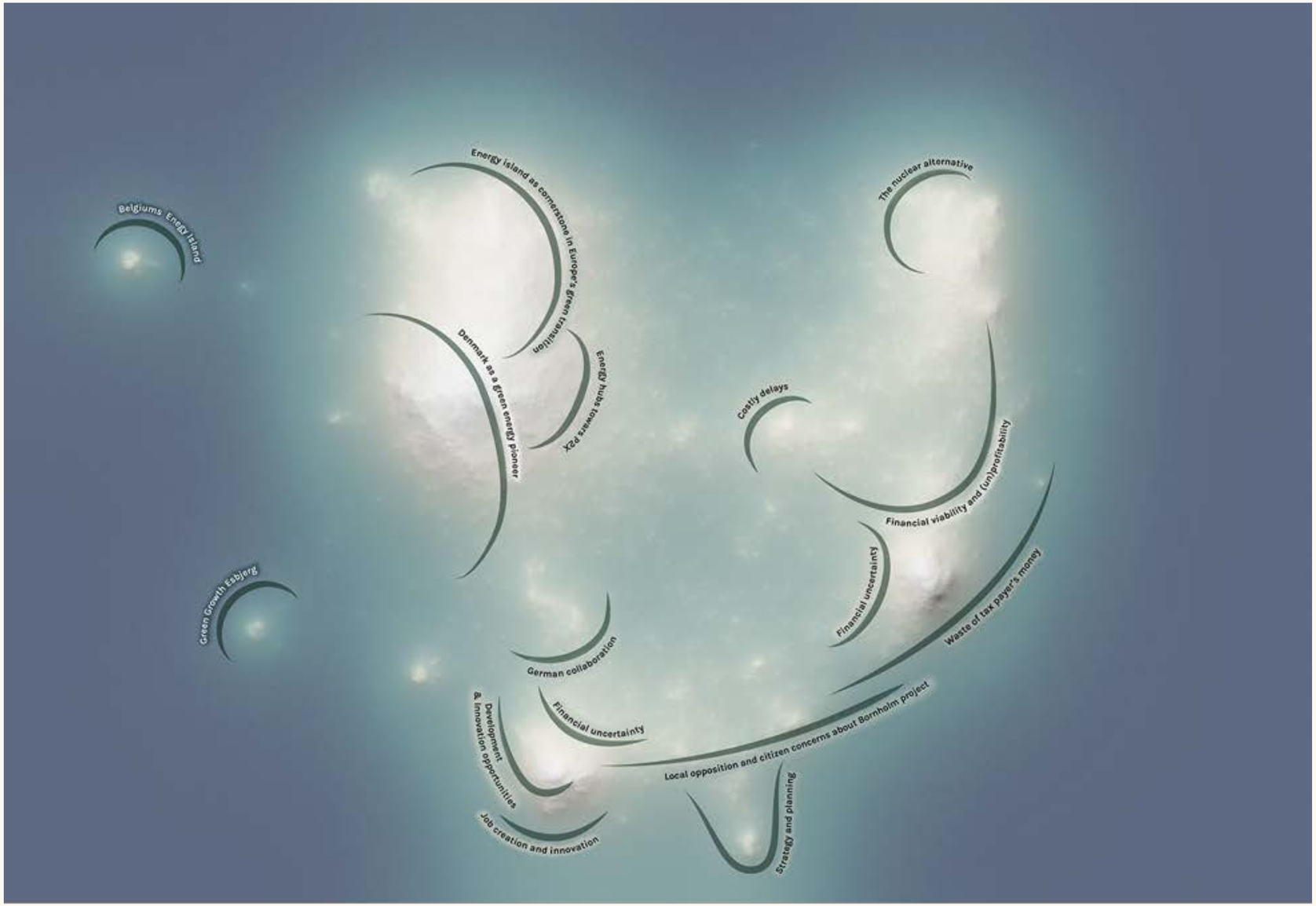
ISSUE OVERVIEW

The issues overviews are versions of the semantic base map with a specific issue from the expert-driven classification projected on top. It allows you to see, where in the semantic map we typically find actor statements that address a given issue, and the top actors making those statements.

ISSUE CO-OCCURRENCE

The co-occurrence matrix allows you to explore how the issues identified through the expert-driven classification are mentioned together.

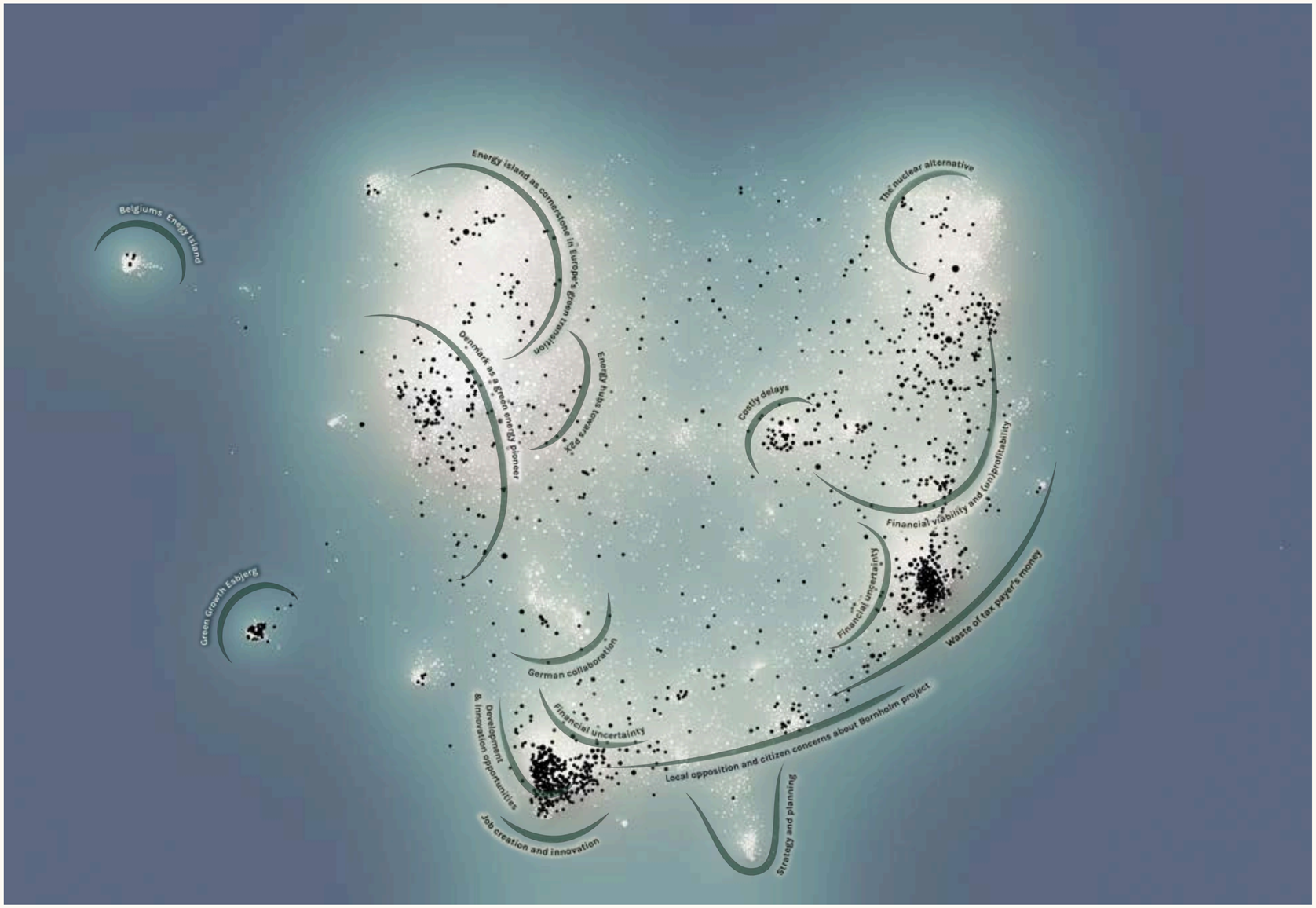
Annotated Basemap



The statements are more or less grouped in clusters in the map, based on their semantic similarity. These clusters have an approximate centerpoint - the centroid. Around each centroid there are between 60 and 200 very closely related statements.

We use an LLM to group them together in annotation batches and prompt the LLM to summarize the content of each cluster in maximum 6 words. These short annotations are the ones you see in the map.

The vague dynamics around them are neither closed areas nor near exact shapes - they are estimates of the radius around the centroid of the cluster where related statements are located.



Issue 1

Are energy islands a good investment for innovation and economic growth?

The hope is that energy islands will boost local and national economic growth. They will require technological innovation, which may have future commercial potential, and their construction could create local jobs. Whether this will happen is subject to discussion. Additionally, if the objective is to stimulate economic growth, the question is also whether there are better ways to invest the money. It has been argued that the projects entail several financial risks, including uncertainty about how energy markets will develop, and that they depend on technological innovations that have yet to materialize.

How big is this issue?

Number of statements: **1221**
Proportional share of all statements: **20.1%**

Proportional share of all actor statements per year

Top 5 actors addressing issue 1

Ranked by the number of statements per actor on this issue.

*Social Media actors have been excluded from top 5

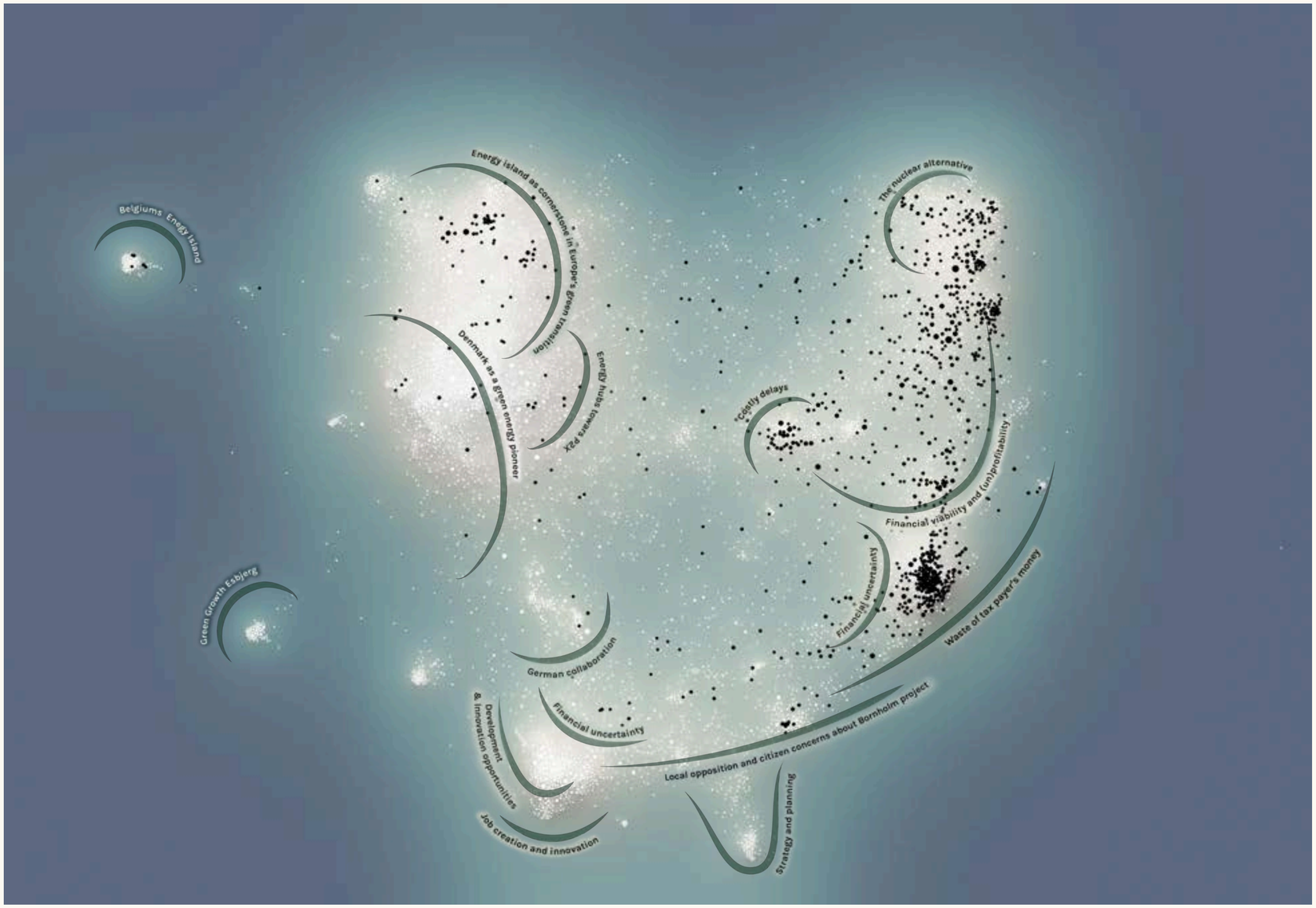
Kraka Economics
48 statements on this issue out of **59** total statements made by this actor.
81.4%
This represents **5.1%** of all the statements any actor has made about this issue.

Lars Aagaard
40 statements on this issue out of **213** total statements made by this actor.
18.8%
This represents **4.2%** of all the statements any actor has made about this issue.

Jacob Trøst
36 statements on this issue out of **82** total statements made by this actor.
43.9%
This represents **3.8%** of all the statements any actor has made about this issue.

Søren Møller Christensen
34 statements on this issue out of **60** total statements made by this actor.
56.7%
This represents **3.6%** of all the statements any actor has made about this issue.

Lea Wermelin
18 statements on this issue out of **41** total statements made by this actor.
43.9%
This represents **1.9%** of all the statements any actor has made about this issue.



● **Issue 2**

Are energy islands the most cost-effective way to reach carbon emission targets?

Cost-efficiency is a frequent argument to be found in arguments supporting energy islands as a valid solution. Yet, some actors question the premises on which the cost-efficiency is assessed. These actors often go on to argue that there are cheaper and existing alternatives to reach net zero goals. Such suggested alternatives include nuclear, combinations of onshore wind and solar, carbon capture and storage, or reducing consumption.

How big is this issue?

Number of statements: **861**
Proportional share of all statements: **14.2%**

Proportional share of all actor statements per year

Top 5 actors addressing issue 2

Ranked by the number of statements per actor on this issue.

*Social Media actors have been excluded from top 5

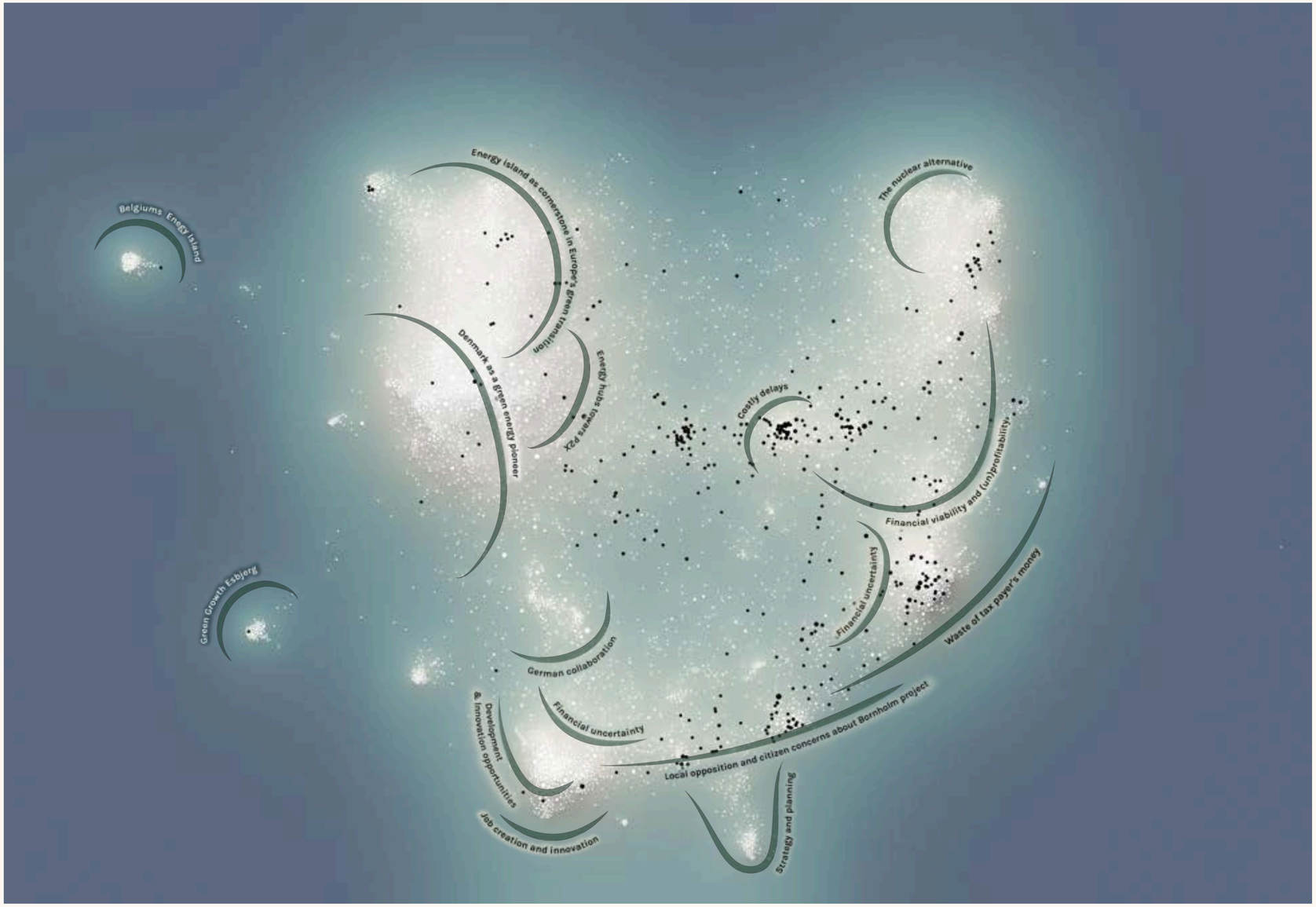
Kraka Economics
43 statements on this issue out of **59** total statements made by this actor.
72.9%
This represents **8%** of all the statements any actor has made about this issue.

Lars Aagaard
39 statements on this issue out of **213** total statements made by this actor.
18.3%
This represents **7.3%** of all the statements any actor has made about this issue.

Frederik Læssøe
22 statements on this issue out of **32** total statements made by this actor.
68.8%
This represents **4.1%** of all the statements any actor has made about this issue.

Mona Juul
16 statements on this issue out of **28** total statements made by this actor.
57.1%
This represents **3%** of all the statements any actor has made about this issue.

Brian Vad Mathiesen
14 statements on this issue out of **50** total statements made by this actor.
28%
This represents **2.6%** of all the statements any actor has made about this issue.



● **Issue 3**

Is bureaucracy slowing down the energy island projects?

Stifling bureaucratic processes are sometimes cited as a challenge. Uncoordinated and lengthy approval processes, lack of transparency, especially in a complicated tender, are seen as causing delays. How do we balance the need to ensure transparency and fairness with the urgency of achieving emission targets?

How big is this issue?

Number of statements: **373**
Proportional share of all statements: **6.2%**

Proportional share of all actor statements per year

Top 5 actors addressing issue 3

Ranked by the number of statements per actor on this issue.

*Social Media actors have been excluded from top 5

Lars Aagaard

37 statements on this issue out of **213** total statements made by this actor.

17.4%

This represents **12.3%** of all the statements any actor has made about this issue.

Kraka Economics

14 statements on this issue out of **59** total statements made by this actor.

23.7%

This represents **4.7%** of all the statements any actor has made about this issue.

Energinet

9 statements on this issue out of **114** total statements made by this actor.

7.9%

This represents **4.1%** of all the statements any actor has made about this issue.

Dan Jørgensen

8 statements on this issue out of **172** total statements made by this actor.

4.7%

This represents **2.7%** of all the statements any actor has made about this issue.

Mona Juul

8 statements on this issue out of **28** total statements made by this actor.

28.6%

This represents **2.7%** of all the statements any actor has made about this issue.

● **Issue 4**

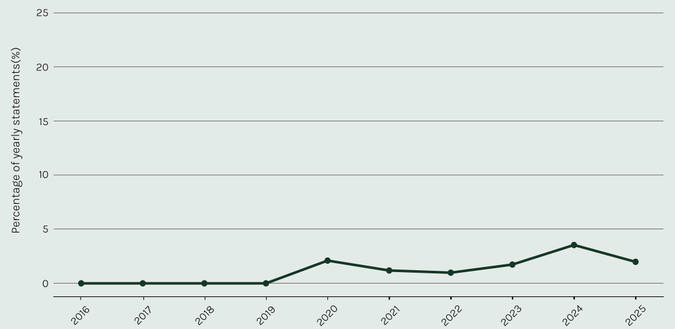
What will the implications be of a new bidding zone for the electricity market?

Danmark has traditionally been divided by the Great Belt into two bidding zones where electricity is traded - DK1 & DK2. Particularly for Bornholm Energy Island it was decided in 2023 to establish a new bidding zone - DK3 – to amend anticipated structural congestion. This comes with cross-border challenges and concerns about impact on price convergence and local energy prices on Bornholm.

How big is this issue?

Number of statements: **209**
Proportional share of all statements: **3.4%**

Proportional share of all actor statements per year



Top 5 actors addressing issue 4

Ranked by the number of statements per actor on this issue.

*Social Media actors have been excluded from top 5

Kraka Economics

18 statements on this issue out of **59** total statements made by this actor.

30.5%

This represents **11.7%** of all the statements any actor has made about this issue.

Lars Aagaard

13 statements on this issue out of **213** total statements made by this actor.

6.1%

This represents **8.4%** of all the statements any actor has made about this issue.

Brian Vad Mathiesen

9 statements on this issue out of **50** total statements made by this actor.

18%

This represents **5.8%** of all the statements any actor has made about this issue.

Frederik Læssøe Nielsen

8 statements on this issue out of **32** total statements made by this actor.

25%

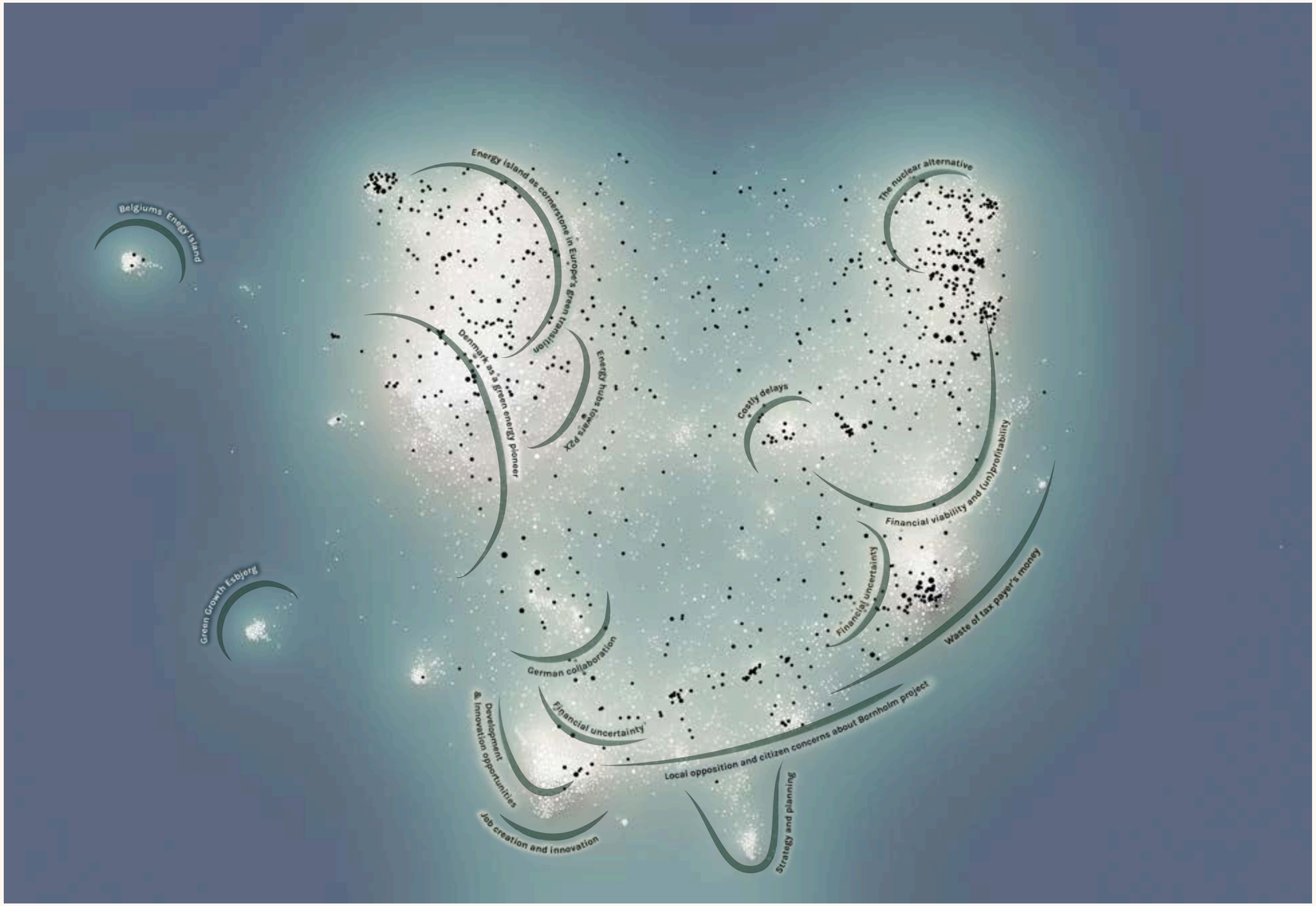
This represents **5.2%** of all the statements any actor has made about this issue.

Energinet

7 statements on this issue out of **114** total statements made by this actor.

6.1%

This represents **4.5%** of all the statements any actor has made about this issue.



Issue 5

Will we have a stable energy supply?

While energy islands are enshrined in Danish law as a key component in the green energy transition, there are concerns about the reliability of a system heavily dependent on intermittent renewable sources like wind. These concerns are related to the need for backup power, energy storage solutions, and the overall security of supply.

How big is this issue?

Number of statements: **755**
Proportional share of all statements: **12.5%**

Top 5 actors addressing issue 5

Ranked by the number of statements per actor on this issue.

*Social Media actors have been excluded from top 5

Lars Aagaard

28 statements on this issue out of **213** total statements made by this actor.

13.1%

This represents **5.7%** of all the statements any actor has made about this issue.

Energinet

15 statements on this issue out of **114** total statements made by this actor.

13.2%

This represents **3.1%** of all the statements any actor has made about this issue.

Jacob Østergaard

14 statements on this issue out of **64** total statements made by this actor.

21.9%

This represents **2.9%** of all the statements any actor has made about this issue.

Frederik Læssøe

13 statements on this issue out of **32** total statements made by this actor.

40.6%

This represents **2.6%** of all the statements any actor has made about this issue.

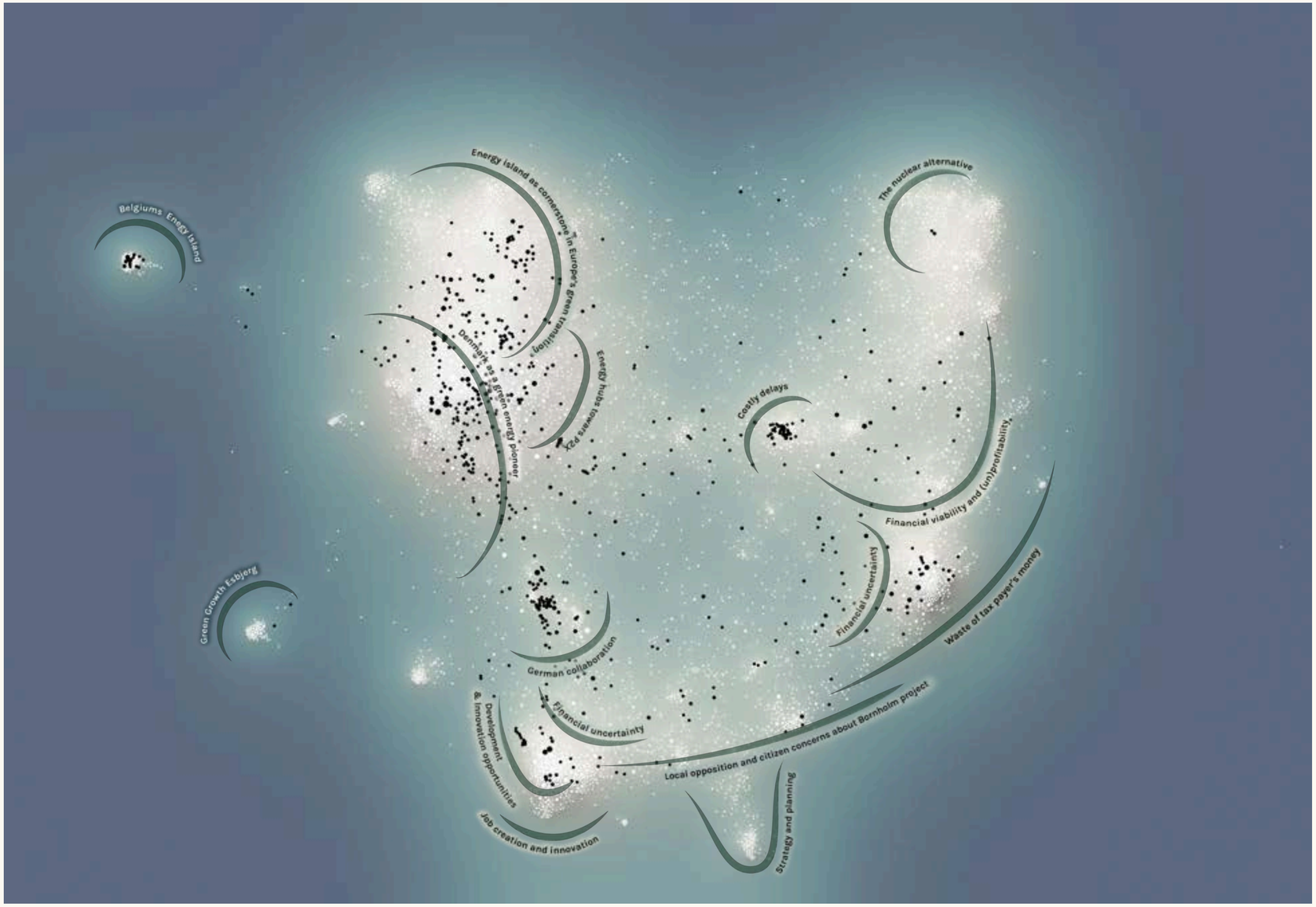
Brian Vad Mathiesen

11 statements on this issue out of **50** total statements made by this actor.

22%

This represents **2.2%** of all the statements any actor has made about this issue.

Proportional share of all actor statements per year



Issue 6

Will the European countries manage to cooperate around offshore energy hubs?

European energy cooperation has always been important but for the energy island projects this cooperation would have to be expanded. Since the islands are shared infrastructure, discussions ensue about shared costs, motivated by shared efforts to reach the European emissions targets, strategic alignment, and shared innovation.

How big is this issue?

Number of statements: **623**
Proportional share of all statements: **10.3%**

Proportional share of all actor statements per year

Top 5 actors addressing issue 6

Ranked by the number of statements per actor on this issue.

*Social Media actors have been excluded from top 5

Lars Aagaard

55 statements on this issue out of **213** total statements made by this actor.

25.8%

This represents **10%** of all the statements any actor has made about this issue.

Dan Jørgensen

33 statements on this issue out of **172** total statements made by this actor.

19.2%

This represents **6%** of all the statements any actor has made about this issue.

Energinet

20 statements on this issue out of **114** total statements made by this actor.

17.5%

This represents **3.6%** of all the statements any actor has made about this issue.

Robert Habeck

17 statements on this issue out of **18** total statements made by this actor.

94.4%

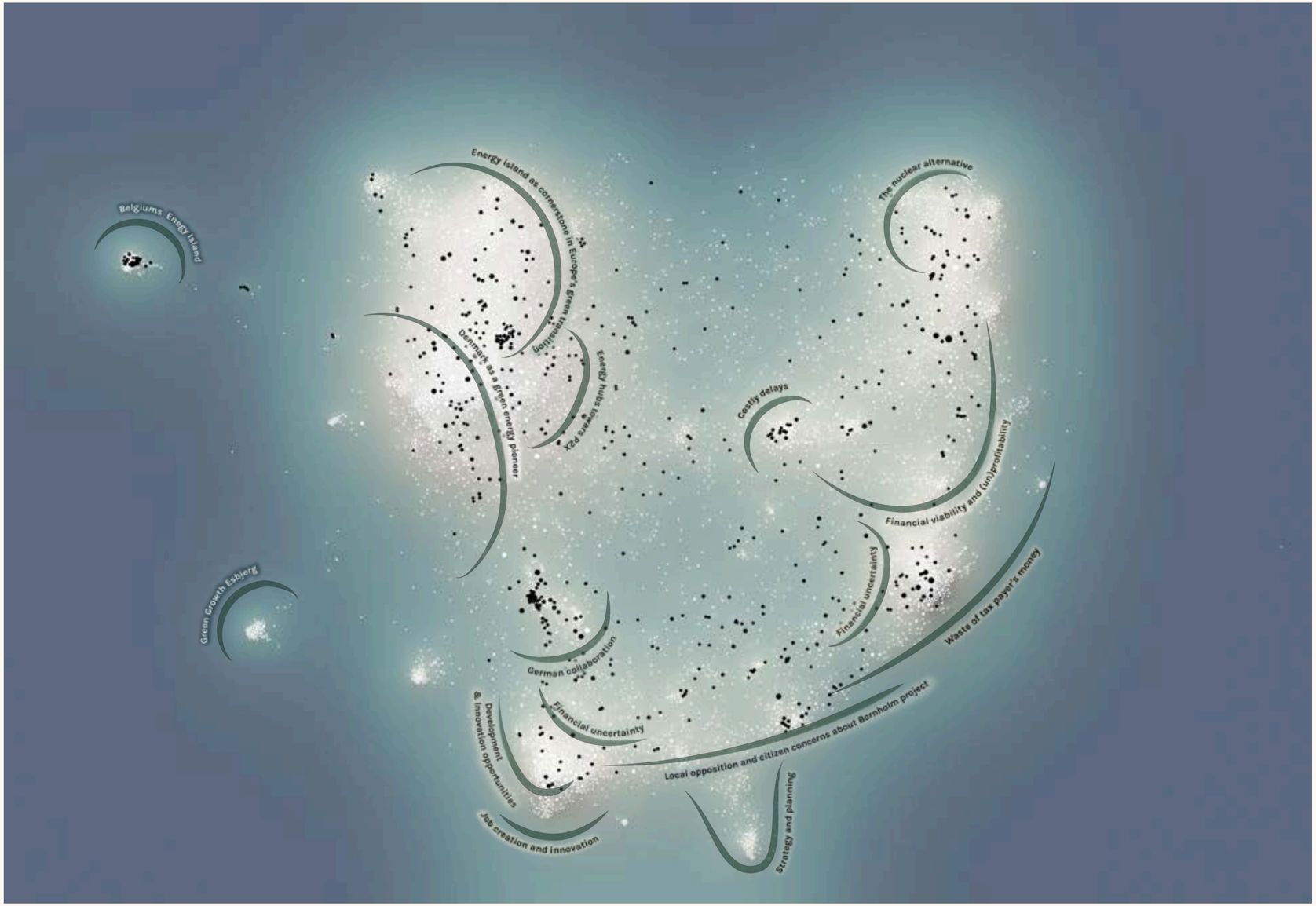
This represents **3.1%** of all the statements any actor has made about this issue.

Jacob Østergaard

15 statements on this issue out of **64** total statements made by this actor.

23.4%

This represents **2.7%** of all the statements any actor has made about this issue.



Issue 7

Geopolitics and energy independence: Will the energy islands make our energy system more resilient or more fragile?

Geopolitical tensions have revitalized discussions about European energy independence. Energy islands are on the one hand championed as a way to increase energy independence by reducing reliance on for example Russian oil and gas. In this context, technologies for energy storage and regional cooperation around energy hubs are often seen as key. However, the centralized infrastructure and increased interdependence that comes with it also raise vulnerability concerns.

How big is this issue?

Number of statements: **617**
Proportional share of all statements: **10.2%**

Proportional share of all actor statements per year

Top 5 actors addressing issue 7

Ranked by the number of statements per actor on this issue.

*Social Media actors have been excluded from top 5

Lars Aagaard

32 statements on this issue out of **213** total statements made by this actor.

15%

This represents **6.8%** of all the statements any actor has made about this issue.

Dan Jørgensen

20 statements on this issue out of **172** total statements made by this actor.

16.9%

This represents **6.2%** of all the statements any actor has made about this issue.

Robert Habeck

12 statements on this issue out of **18** total statements made by this actor.

66.7%

This represents **2.5%** of all the statements any actor has made about this issue.

Søren Møller Christensen

11 statements on this issue out of **60** total statements made by this actor.

18.3%

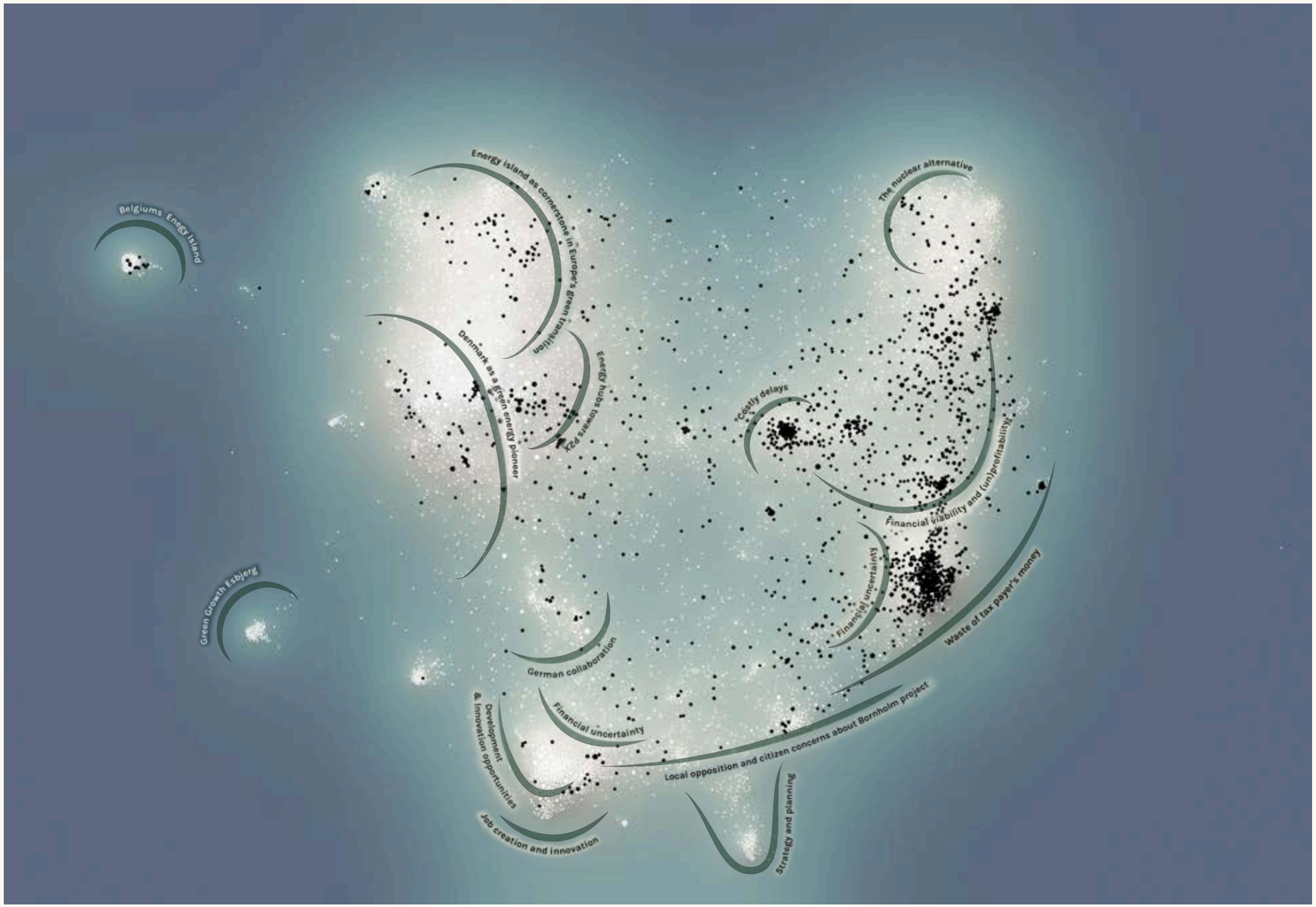
This represents **2.3%** of all the statements any actor has made about this issue.

Energinet

11 statements on this issue out of **114** total statements made by this actor.

9.6%

This represents **2.3%** of all the statements any actor has made about this issue.



Issue 8

How to finance the energy islands?

This issue revolves around the high costs associated with the projects, how these costs should be covered and by whom. There are several aspects to the discussion, for example questions about public versus private funding, questions about the high initial costs, questions about the role of the state and how much risk it should carry, and questions about the market viability of the projects.

How big is this issue?

Number of statements: **1359**
Proportional share of
all statements: **22.4%**

Proportional share of all actor statements per year

Top 5 actors addressing issue 8

Ranked by the number of statements per actor on this issue.

*Social Media actors have been excluded from top 5

Lars Aagaard

130 statements on this issue out of **213** total statements made by this actor.

61%

This represents **12.6%** of all the statements any actor has made about this issue.

Kraka Economics

52 statements on this issue out of **59** total statements made by this actor.

88.1%

This represents **5%** of all the statements any actor has made about this issue.

Morten Messerschmidt

26 statements on this issue out of **30** total statements made by this actor.

86.7%

This represents **2.5%** of all the statements any actor has made about this issue.

Dan Jørgensen

25 statements on this issue out of **172** total statements made by this actor.

14.5%

This represents **2.4%** of all the statements any actor has made about this issue.

Frederik Læssøe

23 statements on this issue out of **32** total statements made by this actor.

71.9%

This represents **2.2%** of all the statements any actor has made about this issue.

Issue 9

Is nuclear power an alternative to energy islands?

Several actors argue that nuclear power could be a more cost-effective alternative because it offers a stable energy supply regardless of weather conditions. While nuclear is often criticized for its lengthy construction times and associated costs, energy island projects have faced similar criticism. You could therefore argue that the Danish ban on nuclear power should be lifted to explore it as a future alternative. From that proposition ensues a range of claims and counterclaims about the safety and location of nuclear power plants, including technological advancements to improve safety and handling of nuclear waste.

How big is this issue?

Number of statements: **276**
Proportional share of all statements: **4.6%**

Proportional share of all actor statements per year

Top 5 actors addressing issue 9

Ranked by the number of statements per actor on this issue.

*Social Media actors have been excluded from top 5

Mona Juul

8 statements on this issue out of **28** total statements made by this actor.

28.6%

This represents **2.9%** of all the statements any actor has made about this issue.

Steffen W. Frølund

6 statements on this issue out of **23** total statements made by this actor.

26.1%

This represents **2.2%** of all the statements any actor has made about this issue.

Kärnfull Energi

5 statements on this issue out of **5** total statements made by this actor.

100%

This represents **1.8%** of all the statements any actor has made about this issue.

3 statements on this issue out of **3** total statements made by this actor.

5.1%

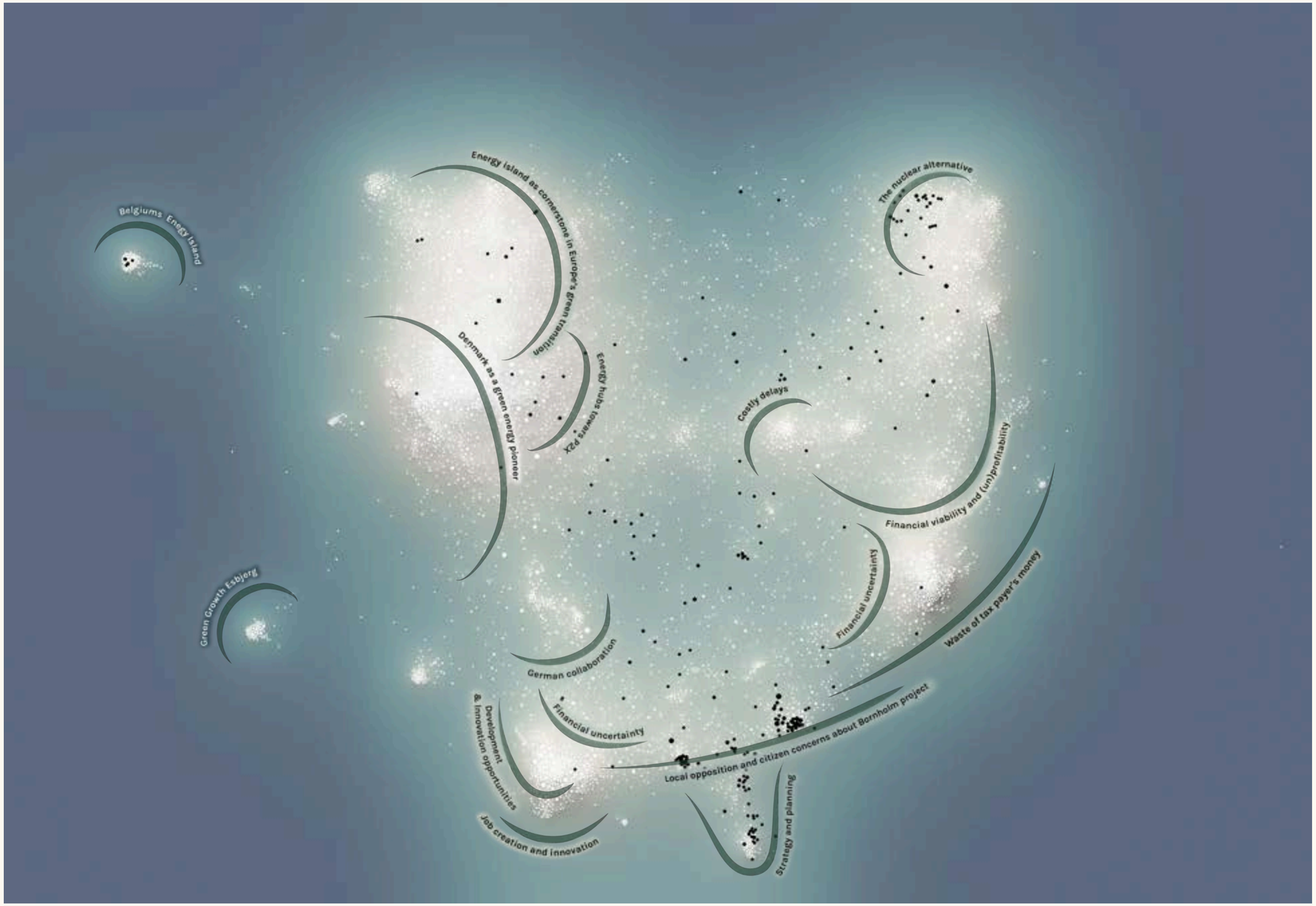
This represents **1.1%** of all the statements any actor has made about this issue.

TerraPower

3 statements on this issue out of **3** total statements made by this actor.

100%

This represents **1.1%** of all the statements any actor has made about this issue.



● **Issue 10**

How will energy islands impact the marine environment?

The concern here is that the construction of offshore infrastructure can lead to significant seabed disturbance, destroying fish habitats and leading to biodiversity loss. Foundation excavation and cable laying could also increase the concentration of suspended sediment in the water, which can displace fish that rely on vision for hunting and feeding. There are concerns that the noise and vibrations caused by construction and maintenance activities might disturb marine life. On the other hand, the foundations of wind turbines and energy islands could also act as artificial reefs, potentially fostering new, diverse habitats for fish, seals, birds, and other marine life. All of these discussions take place in a context where full environmental impact assessments are not yet available.

How big is this issue?

Number of statements: **223**
Proportional share of all statements: **3.7%**

Proportional share of all actor statements per year

Top 5 actors addressing issue 10

Ranked by the number of statements per actor on this issue.

*Social Media actors have been excluded from top 5

Danish Energy Agency
18 statements on this issue out of **157** total statements made by this actor.
11.5%
This represents **8.1%** of all the statements any actor has made about this issue.

Torben Westh Jensen
11 statements on this issue out of **25** total statements made by this actor.
44%
This represents **4.9%** of all the statements any actor has made about this issue.

Danish Society for Nature Conservation
5 statements on this issue out of **11** total statements made by this actor.
45.5%
This represents **2.2%** of all the statements any actor has made about this issue.

Energinet
5 statements on this issue out of **114** total statements made by this actor.
4.4%
This represents **2.2%** of all the statements any actor has made about this issue.

Maria Reumert Gjerding
4 statements on this issue out of **4** total statements made by this actor.
100%
This represents **1.8%** of all the statements any actor has made about this issue.

Issue 11

How will energy islands impact local communities?

On Bornholm, concerns include that the energy island projects may lead to the expropriation and demolition of homes, displacing residents and impacting local economies, landscapes and cultural heritage without locals being properly consulted or compensated. In other instances, the economic benefits of the construction are positively discussed, although it is also questioned whether the projects will have lasting economic benefits for the local communities beyond the construction phase.

How big is this issue?

Number of statements: **494**
Proportional share of all statements: **8.2%**

Proportional share of all actor statements per year

Top 5 actors addressing issue 11

Ranked by the number of statements per actor on this issue.

*Social Media actors have been excluded from top 5

Jacob Trøst
29 statements on this issue out of 82 total statements made by this actor.
35.4%
This represents **5.9%** of all the statements any actor has made about this issue.

Torben Westh Jensen
19 statements on this issue out of 25 total statements made by this actor.
76%
This represents **3.8%** of all the statements any actor has made about this issue.

Center for Regional and Tourism Research
9 statements on this issue out of 21 total statements made by this actor.
42.9%
This represents **1.8%** of all the statements any actor has made about this issue.

Søren Møller Christensen
9 statements on this issue out of 60 total statements made by this actor.
15%
This represents **1.8%** of all the statements any actor has made about this issue.

Lise Dandanell
9 statements on this issue out of 18 total statements made by this actor.
50%
This represents **1.8%** of all the statements any actor has made about this issue.

● **Issue 12**

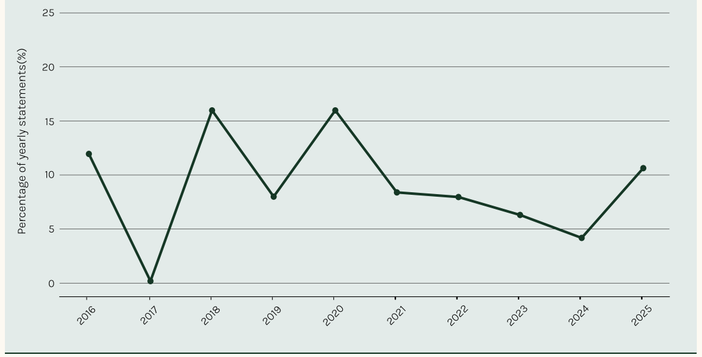
What are the current envisioned ideas of interplay between Power-to-X and energy islands?

Power-to-X technologies are frequently discussed in relation to energy islands because they are seen as crucial for maximizing the potential of renewable energy sources and addressing some of their inherent challenges, particularly energy storage in times of overproduction and also as a tool for ensuring grid stability. Political initiatives and the recent launch of the Kassø PtX plant have supported hopes in these ambitions, but many things remain unresolved including the high costs of PtX facilities and energy loss in the conversion process.

How big is this issue?

Number of statements: **524**
Proportional share of all statements: **8.6%**

Proportional share of all actor statements per year



Top 5 actors addressing issue 12

Ranked by the number of statements per actor on this issue.

*Social Media actors have been excluded from top 5

Dan Jørgensen

21 statements on this issue out of **172** total statements made by this actor.

12.2%

This represents **4%** of all the statements any actor has made about this issue.

Brian Vad Mathiesen

12 statements on this issue out of **50** total statements made by this actor.

24%

This represents **2.3%** of all the statements any actor has made about this issue.

Lars Aagaard

10 statements on this issue out of **213** total statements made by this actor.

4.7%

This represents **1.9%** of all the statements any actor has made about this issue.

Thomas Dalsgaard

9 statements on this issue out of **41** total statements made by this actor.

22%

This represents **1.7%** of all the statements any actor has made about this issue.

COWI

9 statements on this issue out of **42** total statements made by this actor.

21.4%

This represents **1.7%** of all the statements any actor has made about this issue.

Issue 13

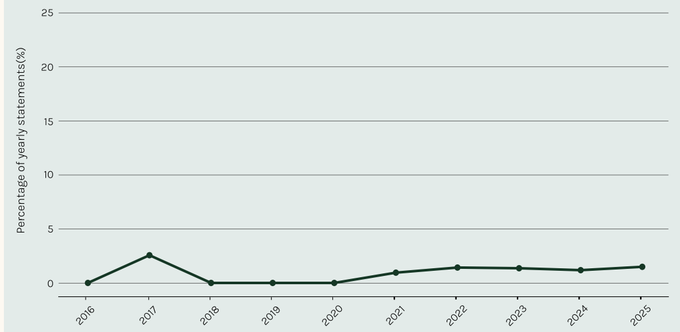
From cyber to sabotage – are energy islands a security risk?

Energy islands are critical infrastructure and have over time raised more and more security concerns. Cybersecurity is for example an issue because of the digital control technologies that support that support them, and the undersea cable infrastructure could make them vulnerable to sabotage. A hub thus provides a high value target.

How big is this issue?

Number of statements: **111**
Proportional share of all statements: **1.8%**

Proportional share of all actor statements per year



Top 5 actors addressing issue 13

Ranked by the number of statements per actor on this issue.

*Social Media actors have been excluded from top 5

Troels Lund Poulsen

5 statements on this issue out of **5** total statements made by this actor.

100%

This represents **4.5%** of all the statements any actor has made about this issue.

Energinet

4 statements on this issue out of **114** total statements made by this actor.

3.5%

This represents **3.6%** of all the statements any actor has made about this issue.

Vincent Van Quickenborne

4 statements on this issue out of **6** total statements made by this actor.

66.7%

This represents **3.6%** of all the statements any actor has made about this issue.

Danish Energy Agency

3 statements on this issue out of **153** total statements made by this actor.

1.9%

This represents **2.7%** of all the statements any actor has made about this issue.

Samira Nawa

2 statements on this issue out of **11** total statements made by this actor.

18.2%

This represents **1.8%** of all the statements any actor has made about this issue.

● **Issue 14**

How sustainable are the building materials for the energy islands?

The construction of energy islands requires substantial amounts of building materials like steel, concrete, and copper. Some question whether the use of these materials is sustainable, due to the way they are sourced and the emissions associated with their production and transportation.

Top 5 actors addressing issue 14

Ranked by the number of statements per actor on this issue.

*Social Media actors have been excluded from top 5

Danish Society for Nature Conservation
3 statements on this issue out of **11** total statements made by this actor.
27.3%
This represents **4.2%** of all the statements any actor has made about this issue.

Holcim Belgium
2 statements on this issue out of **2** total statements made by this actor.
100%
This represents **2.8%** of all the statements any actor has made about this issue.

Arne Havgaard
1 statements on this issue out of **1** total statements made by this actor.
100%
This represents **1.4%** of all the statements any actor has made about this issue.

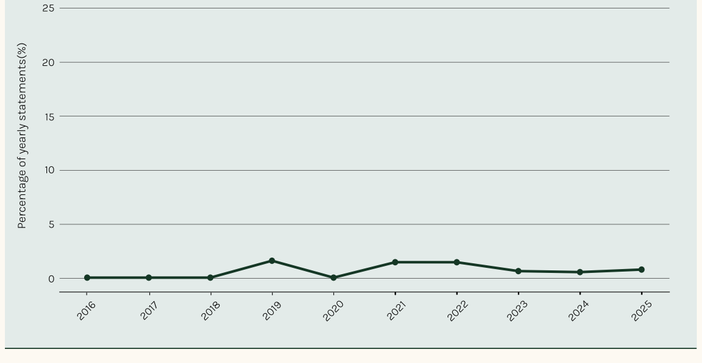
COWI
1 statements on this issue out of **42** total statements made by this actor.
2.4%
This represents **1.4%** of all the statements any actor has made about this issue.

Alvar Nyrén
1 statements on this issue out of **4** total statements made by this actor.
100%
This represents **1.4%** of all the statements any actor has made about this issue.

How big is this issue?

Number of statements: **71**
Proportional share of all statements: **1.2%**

Proportional share of all actor statements per year



● **Issue 15**

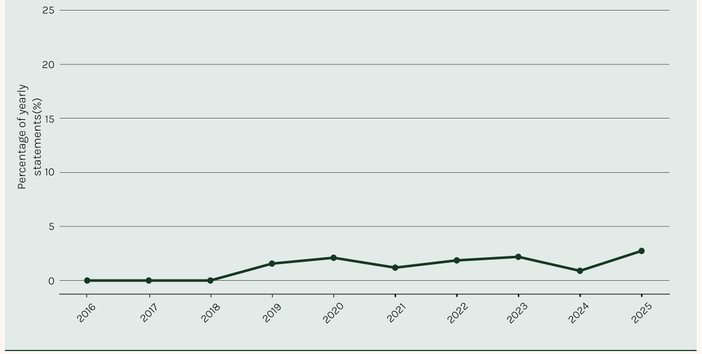
How can High Voltage Direct Current (HVDC) technology be integrated into the electricity system?

HVDC is a crucial technology for the energy islands. However, it is well known that the integration of HVAC and HVDC technologies presents complex technical challenges and that HVDC does not allow for the transmission of VAR (Variable Ampere Reactive) power, meaning there is no voltage support at the reception end. Particularly multi-terminal HVDC solutions raise questions. There is a lack of developed standards, it is seen by some as a new and risky technology, which leads to concerns about cost. HVDC circuit breakers scaled to energy islands capacities are indispensable and will need to be developed.

How big is this issue?

Number of statements: **127**
Proportional share of all statements: **2.1%**

Proportional share of all actor statements per year



Top 5 most prominent actors addressing issue 15

Total Statements and Share of Issue 1 Relative to All Their Issue Mentions

*Social Media actors have been excluded from top 5

Hanne Storm Edlefsen

7 statements on this issue out of **66** total statements made by this actor.

10.6%

This represents **5.5%** of all the statements any actor has made about this issue.

Energinet

7 statements on this issue out of **114** total statements made by this actor.

6.1%

This represents **5.5%** of all the statements any actor has made about this issue.

Stefan Kapferer

4 statements on this issue out of **15** total statements made by this actor.

26.7%

This represents **3.1%** of all the statements any actor has made about this issue.

Bornholm Energy & Supply

3 statements on this issue out of **9** total statements made by this actor.

33.3%

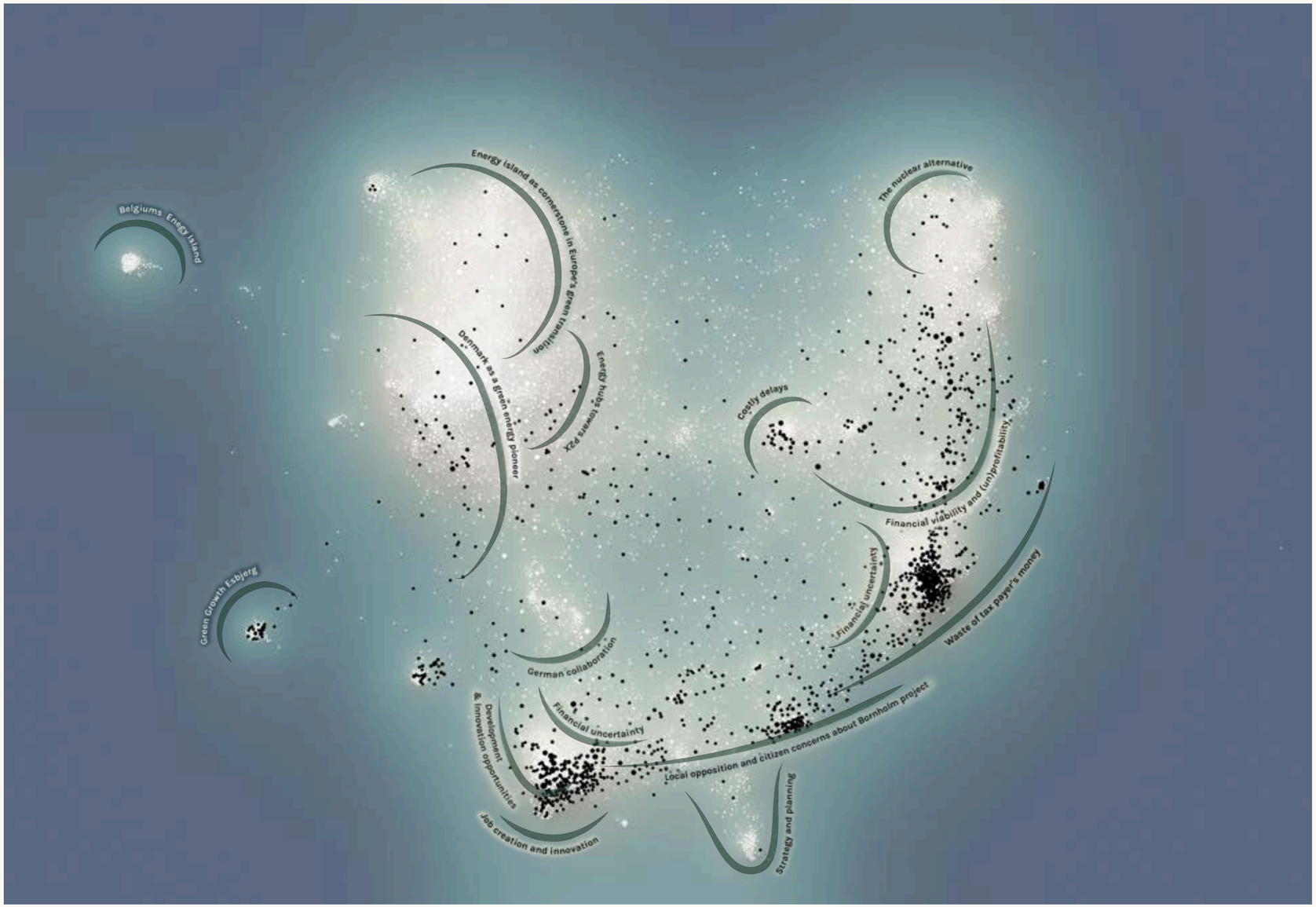
This represents **2.4%** of all the statements any actor has made about this issue.

Jacob Østergaard

3 statements on this issue out of **64** total statements made by this actor.

4.7%

This represents **2.4%** of all the statements any actor has made about this issue.



● **Issue 16**

Are the energy islands socially and economically just?

Who will gain and who will bear the burdens of realizing the energy islands? These discussions revolve around the distribution of benefits, financial burdens, and the overall impact on society. Will the energy islands generate a net socio-economic benefit? To what extent should taxpayers bear the burden? Will the projects create jobs and for whom? Will the local communities be properly involved? Is there some form of co-ownership and how can you ensure social acceptance?

How big is this issue?

Number of statements: **1140**
Proportional share of all statements: **12.1%**

Proportional share of all actor statements per year

Top 5 actors addressing issue 16

Ranked by the number of statements per actor on this issue.

*Social Media actors have been excluded from top 5

Kraka Economics
50 statements on this issue out of **59** total statements made by this actor.
84.7%
This represents **4.4%** of all the statements any actor has made about this issue.

Lars Aagaard
50 statements on this issue out of **213** total statements made by this actor.
23.5%
This represents **4.4%** of all the statements any actor has made about this issue.

Jacob Trøst
44 statements on this issue out of **82** total statements made by this actor.
53.7%
This represents **3.9%** of all the statements any actor has made about this issue.

Søren Møller Christensen
23 statements on this issue out of **60** total statements made by this actor.
38.3%
This represents **2%** of all the statements any actor has made about this issue.

Morten Messerschmidt
22 statements on this issue out of **30** total statements made by this actor.
73.3%
This represents **1.9%** of all the statements any actor has made about this issue.

ENERGY ISLANDS
The Issue Atlas

Case material for
sociotechnical Controversies

June 2025

Issue co-occurrence matrix

size:
number of co-occurrences

· 1 — 1045

color:
Proportion of total possible co-occurrences

0.0 — 0.5 — 1.0

ENERGY ISLANDS
The Issue Atlas

Contributors

Students and Teaching assistants

This case material came together thanks to the work and input of the students from the Science, Technology and Society course, January 2025. Also thanks to the teaching assistants, who kept things running and helped coordinate the course.

Project team

Echolab. DTU Management

ECHO Lab develops tools for better consideration of diverse human experiences and perspectives in technology development. We experiment with large-scale integrations of qualitative, computational, and participatory methods to understand how human experience is shaped by technology and how humans relate differently to technological problems.

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Good-by-devicing. ERC-funded project

This case material was co-developed with the ERC-funded project 'Good-by-devicing: Probing how value comes to matter in the energy transition - the case of energy islands' **(Good-by-Devicing - Probing how value comes to matter in the energy transition).** In the Good-by-Devicing project, we trace controversies over the energy transition, paying attention as to how – and by and for whom and what – the energy transition is construed as 'good'. The project uses the case of the contested development of the world's first 'energy islands' in Denmark to explore this. The natural island of Bornholm is used as a strategic research site to ask how the energy transition could be valued otherwise. In particular, we zoom in on the early 'design phase' of the energy transition where critical design tools and devices are developed, and which include and exclude particular valuations, with consequences for whose concerns are heard.

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The Observatory for Human Centered Engineering

Public Data Lab

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