

POSITIVE ENERGY

DISTRICT HILLEVÅG

Written by Siddharth Sareen and Yonas Tesema Amaya
Illustrated by Leo Ribeiro





Positive Energy District Hillevåg

This comic book is based on research and innovation conducted as part of the ENERGY4ALL project on communities for positive energy districts, funded by the Research Council of Norway (grant 349994) through the Driving Urban Transitions initiative in Europe. It presents the process and outcomes of cooperation undertaken between the University of Stavanger, Stavanger Municipality, heavy industries Felleskjøpet Rogaland Agder and Skretting during 2024–2026, alongside other local stakeholders such as the energy company Lyse as well as European project partners. It draws upon two articles authored by Yonas Tesema Amaya at the University of Stavanger and Siddharth Sareen at the Fridtjof Nansen Institute, with a focus on a Positive Energy District endeavour in Stavanger, PED Hillevåg.

The first article is:

Tesema, Y. and Sareen, S. 2026. The pathways to net-zero: challenges, experiences and firm-level decarbonization strategies in the manufacturing sector. *Sustainable Futures* 12, 102081.

It is available open access online at

<https://doi.org/10.1016/j.sftr.2026.102081>

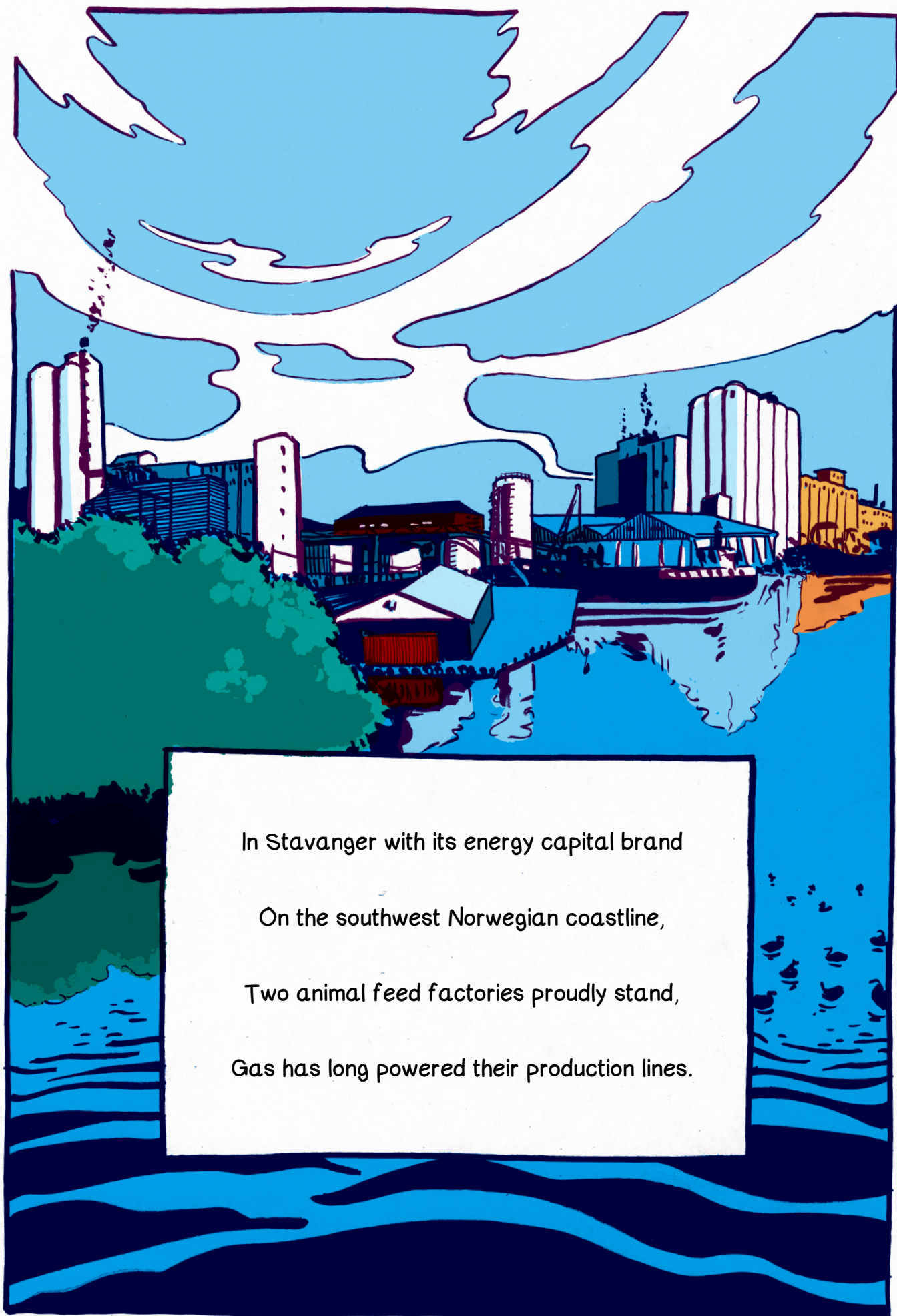
The second article is:

Tesema, Y. and Sareen, S. 2026. Fostering sustainability transformation through effective collaboration among stakeholders. *Urban Research & Practice*, 1–11.

It is available open access online at

<https://doi.org/10.1080/17535069.2026.2720234>

The first pages of both articles are featured at the end of this comic book for interested readers, who are welcome to contact ssareen@fni.no



In Stavanger with its energy capital brand
On the southwest Norwegian coastline,
Two animal feed factories proudly stand,
Gas has long powered their production lines.



Yet with 2030 looming came ambitious plans
To bring the city's climate footprint down,
The factory managers cast an uneasy glance.
At what the carbon accountants had found.

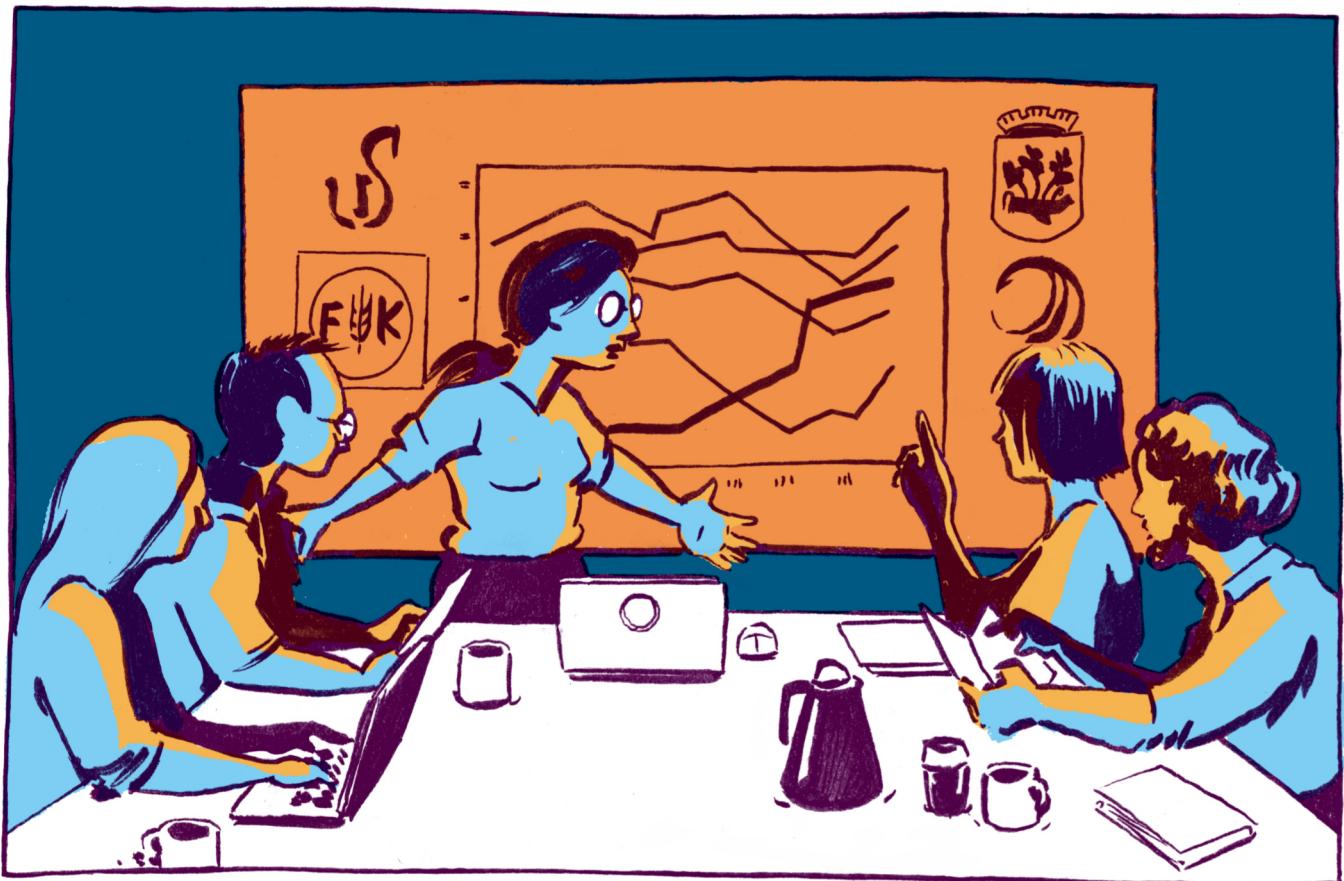
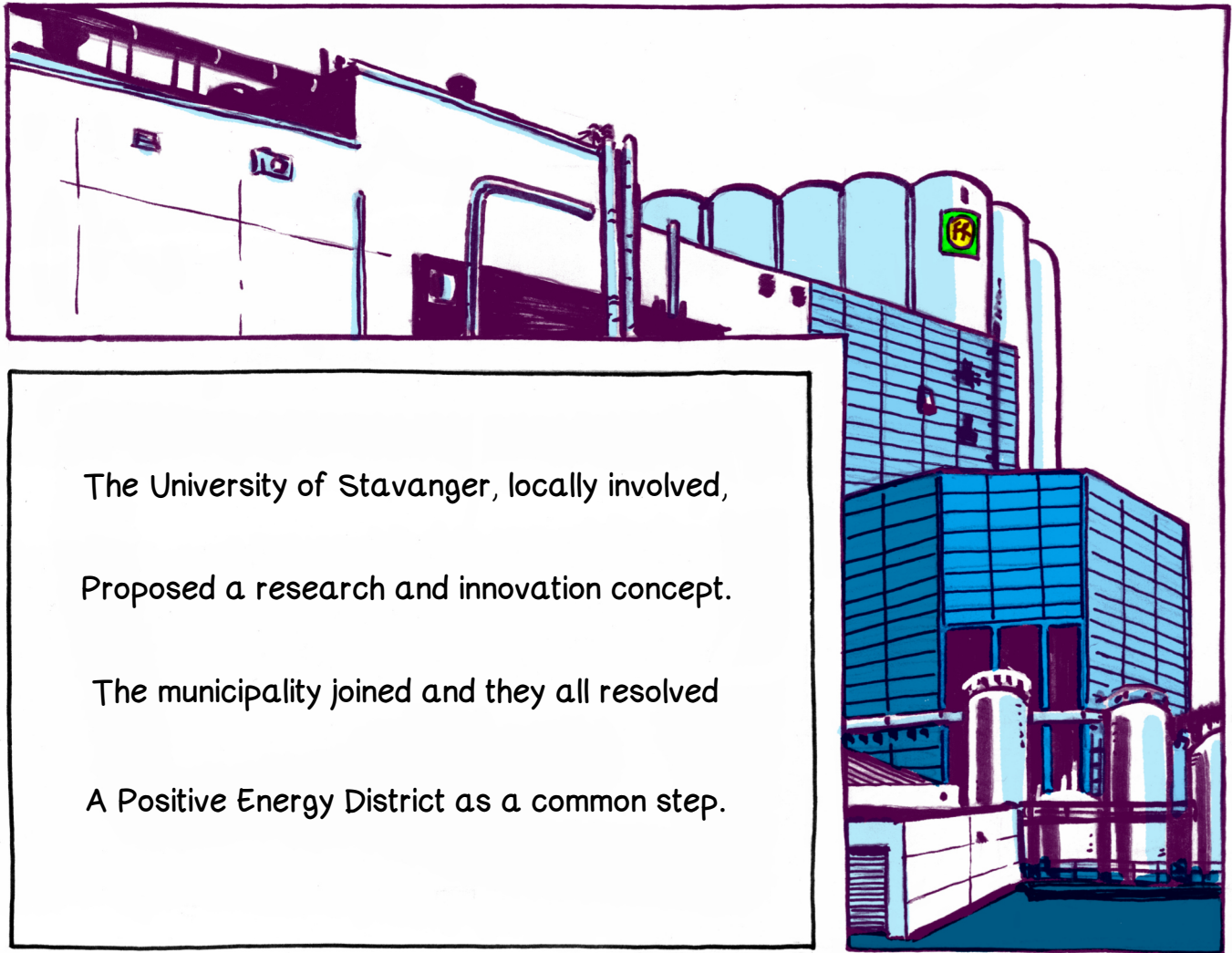
Emissions were about to get very pricey,

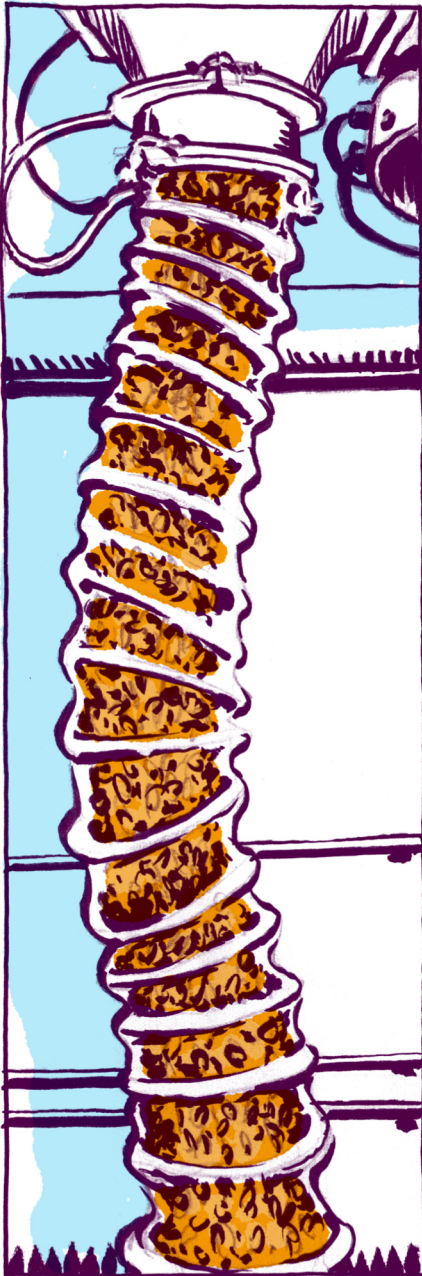
Moving away from gas made business sense.

But this major operational shift felt dicey,

They needed to take stock of all options.

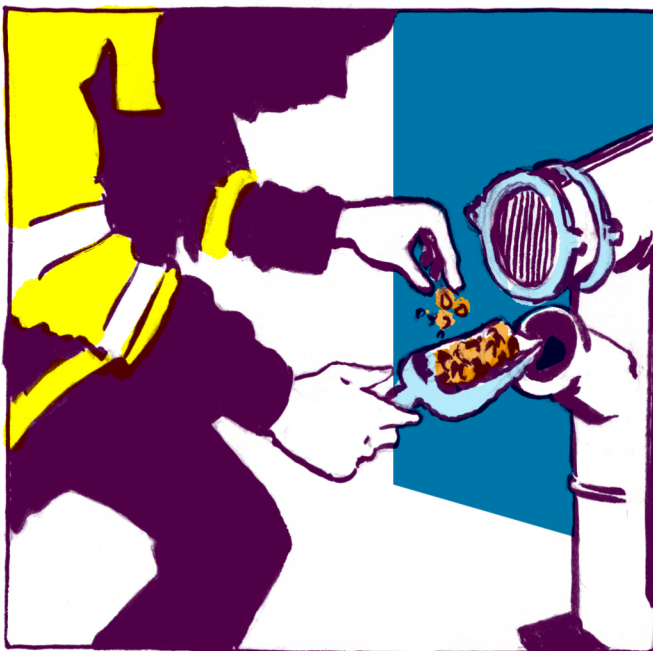
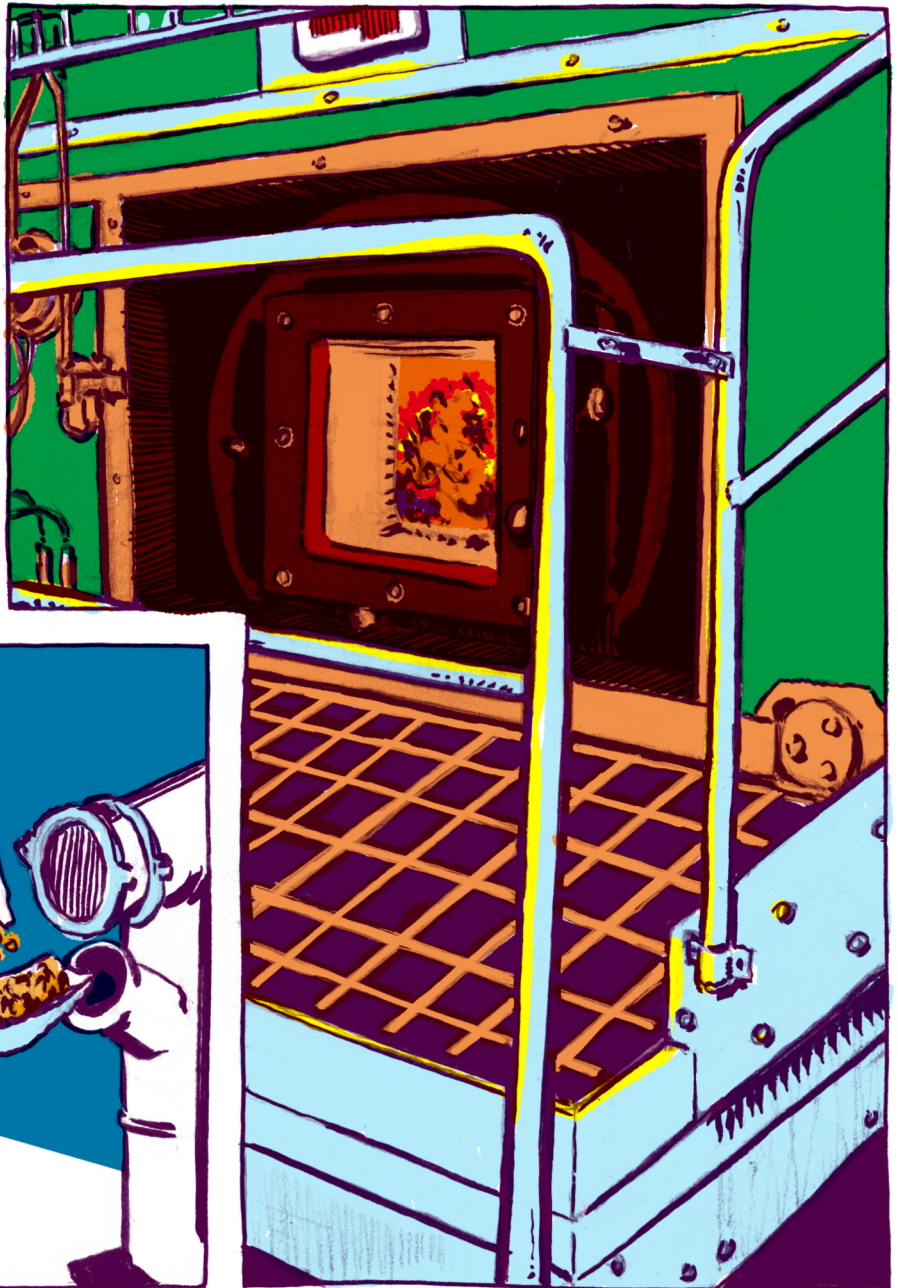


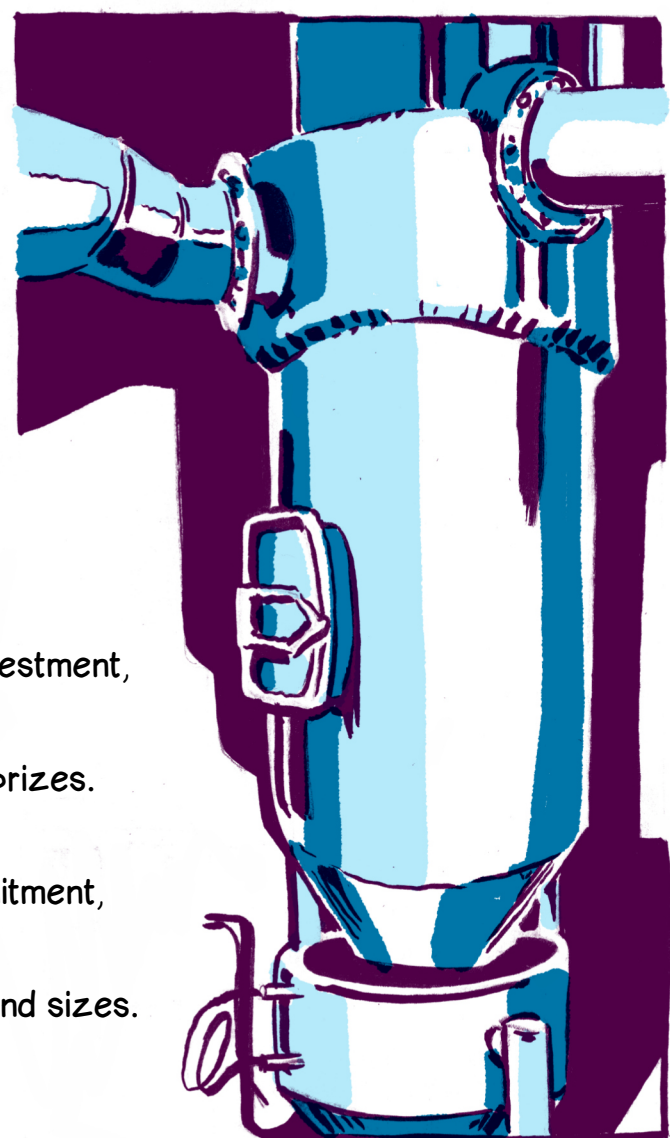
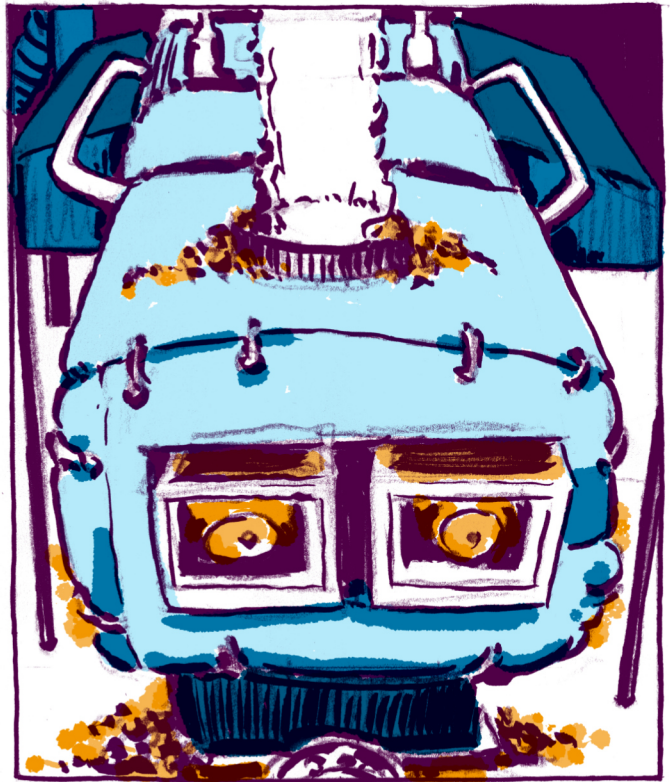




Electricity systems operator Lyse liked the plan
With European funds, the first success was tasted.

One factory would invest in a biomass plant
Fed by oat hulls that the farmers usually wasted.





The other factory made efficiency investment,

Reduced their energy use and won prizes.

PED Hillevåg showed that with commitment,

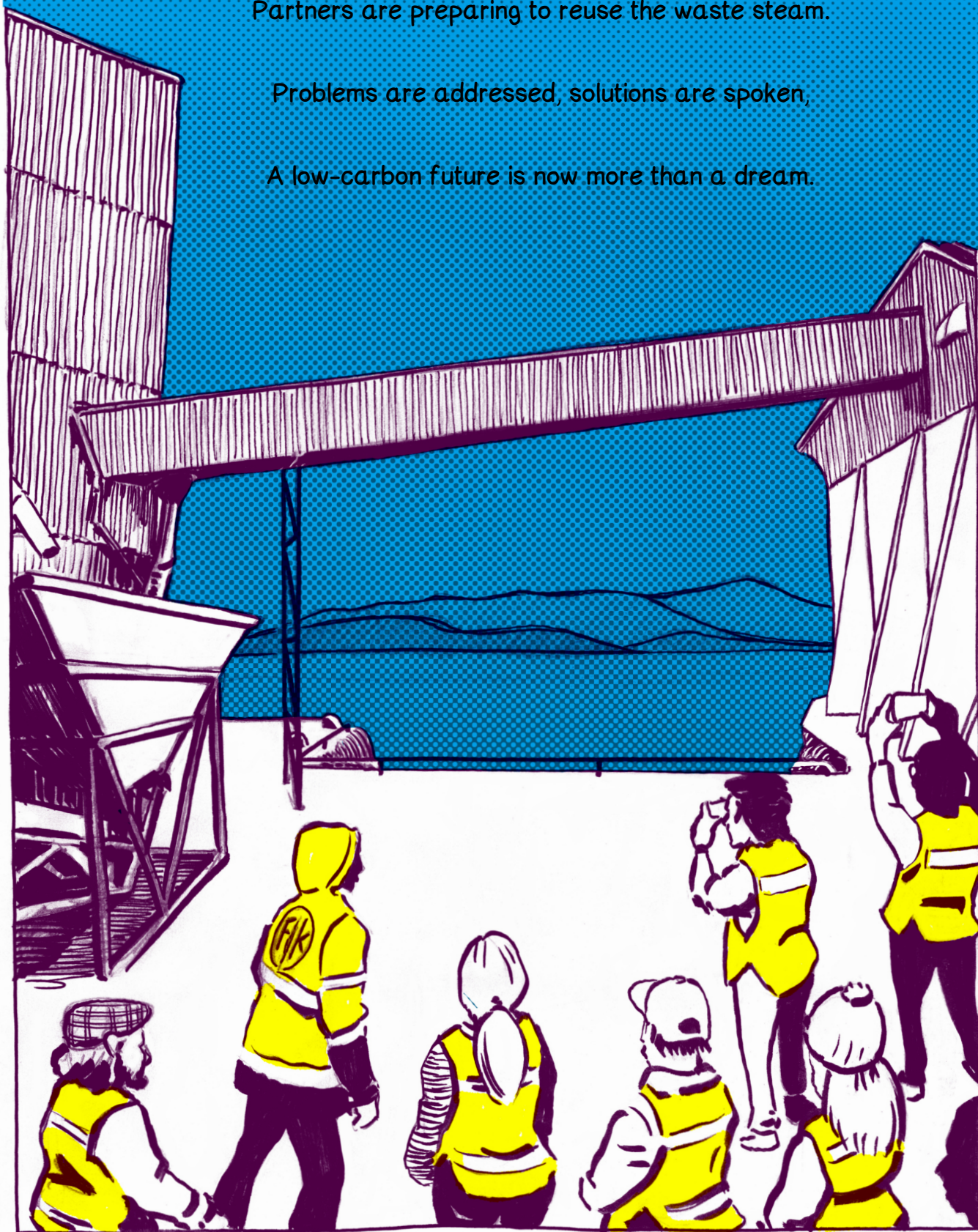
Decarbonisation comes in all shapes and sizes.

Collaborating across sectors, barriers are broken,

Partners are preparing to reuse the waste steam.

Problems are addressed, solutions are spoken,

A low-carbon future is now more than a dream.

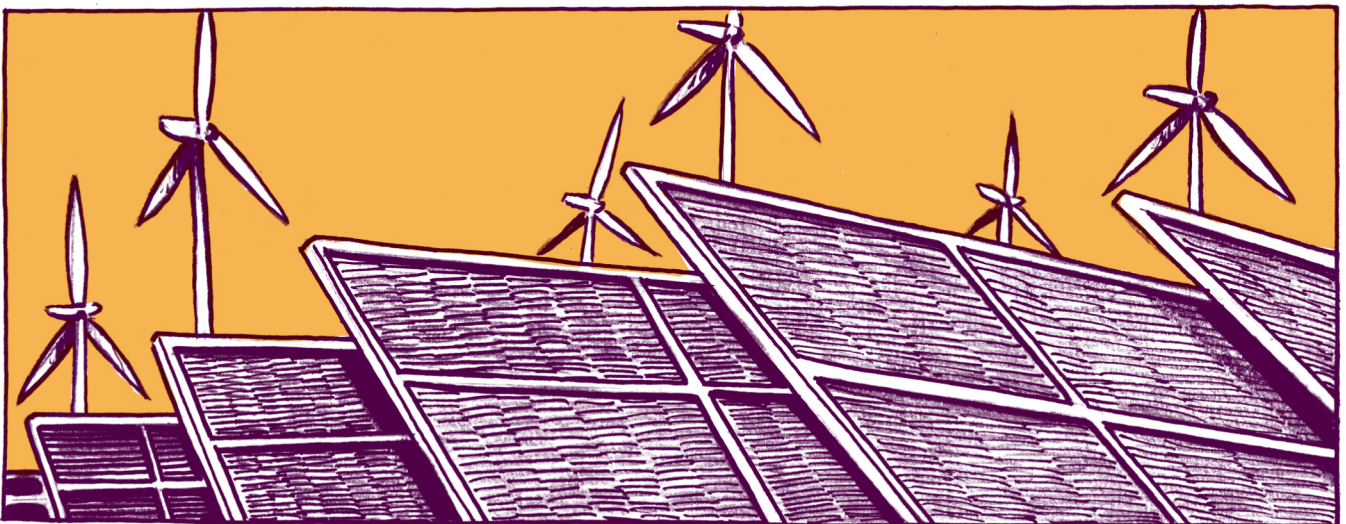


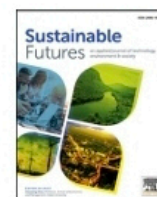
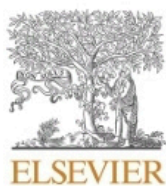
If we join forces and try, it is feasible to do good,

Regulatory pressure can steer green innovation.

The model shown in one plucky neighbourhood

Can inspire others in and beyond our nation!





The pathways to net-zero: challenges, experiences and firm-level decarbonization strategies in the manufacturing sector

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ABSTRACT

Industrial decarbonization strategies include transitioning to cleaner energy sources, optimizing production processes, and recovering waste heat in energy-intensive sectors. Manufacturing industries with high energy demands are experiencing structural transformation to facilitate net-zero transitions. Despite these developments, there is limited research on how individual firms implement decarbonization strategies within distinct regulatory and market contexts. This article addresses this gap by analysing firm-level decarbonization strategies at Felleskjøpet and Skretting, two feed-producing industries located in Stavanger, Norway. It provides an in-depth assessment of their energy transition initiatives, including waste heat utilization and energy efficiency enhancements, as well as the institutional, financial, and technological barriers that hinder faster transition progress. By identifying best practices and barriers at the firm level, this research provides policy-relevant insights for municipalities, energy providers, and national regulators seeking to accelerate industrial decarbonization.

1. Introduction

To effectively address climate change, the world must transition to low-carbon energy systems and achieve deep decarbonization by 2050. This will require low-carbon transitions across all sectors, including industry, electricity and heat production, transportation, agriculture, and the built environment [1–3]. Meeting this challenge will involve significant innovation, such as waste heat recovery and carbon capture and storage across various industrial sectors, to reduce greenhouse gas (GHG) emissions [3]. While renewable energy sources have been increasingly adopted over the past decade [4], achieving a net-zero target in most industrial sectors still presents a significant challenge [5]. Although industrial manufacturing has significantly driven the world's economic growth, it has far-reaching adverse consequences in terms of GHG emissions, making it crucial to act quickly to decarbonize the industrial sector to mitigate climate risks and achieve carbon neutrality [6].

Decarbonizing the economy requires an integrated approach among governments, businesses, and industries. Governments, environmentalists and climate scientists are pressuring heavy industries that consume massive amounts of energy to switch to cleaner energy sources and

develop strategic plans to achieve net zero [7]. This is because the industrial sector consumes approximately one-third of the world's final energy demand and contributes directly or indirectly to about one-third of global emissions [8]. Following the EU's carbon-neutral net-zero emission plan (i.e., cutting 55% of GHG emissions by 2030 and over 80% by 2050 compared to the 1990 level) [9], Norway devised a national climate action plan to reduce its emissions by 55% in 2030 and 90–95% in 2050 [10]. However, its current pace lags the national target, accounting for only a 27% reduction in GHG emissions by 2030 and an 80% reduction by 2050 compared to the 1990 level [10]. Stepping up the pace of the transition is thus imperative for decarbonizing the economy, and the role of heavy, energy-intensive manufacturing industries is considerable, given that the industrial sector in Norway consumes 30% of the country's energy demand [10]. Achieving the ambitious net-zero target thus will require the industrial sector's concerted and rapid efforts. In so doing, municipal governments' low-carbon energy system plans and firm-level decarbonization strategies are crucial.

Drawing on interviews with stakeholders and observations at Felleskjøpet and Skretting, this paper explores firm-level decarbonization strategies in the animal and fish feed-producing industries in Stavanger,

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Fostering sustainability transformation through effective collaboration among stakeholders

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ABSTRACT

Achieving the ambitious goal of net-zero emissions and carbon neutrality involves a complex, transformative process requiring effective collaboration across multiple sectors and scales. Although stakeholder engagement is well documented in sustainability transformation research, critical reflection on the nature of such engagement remains limited. The factors that hinder or facilitate effective collaboration among diverse stakeholders with varying visions, interests, and priorities remain poorly understood. In this Perspective, we analyse the challenges and opportunities of effective collaboration and identify mechanisms to strengthen cooperation, thereby improving prospects for successful sustainability transformation. Our reflections seek to guide stakeholders engaged in sustainability transformation and enhance partnerships for a sustainable future.

ARTICLE HISTORY

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KEYWORDS

Effective collaboration; sustainability transformation; challenges of collaboration; stakeholders; just transition

1. The need for effective collaboration in sustainability transformation

To understand the need for effective collaboration and how its absence can derail sustainability transformation, the Desertec Industrial Initiative is a good example. Desertec was a large-scale transcontinental renewable energy infrastructure initiative launched in 2009 to generate solar energy from the Sahara Desert and the Arabian Peninsula and supply Europe with a large-scale renewable energy source. However, despite the initiative receiving financial support from major firms at the outset, Desertec failed within a couple of years due to a lack of effective collaboration across institutional, geographic, and socio-political boundaries that constitute a multitude of actors with different priorities, visions and interests, including European corporations, North African governments, and multilateral organizations (Schmitt 2018). The differing interests among stakeholders led to conflicting priorities and a breakdown in trust, which eventually derailed the initiative.

To achieve carbon neutrality by 2050, the Paris Climate Agreement encourages national governments to pursue sustainability transformations that make socio-

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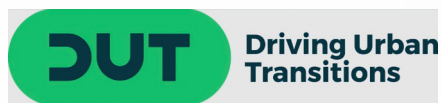
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