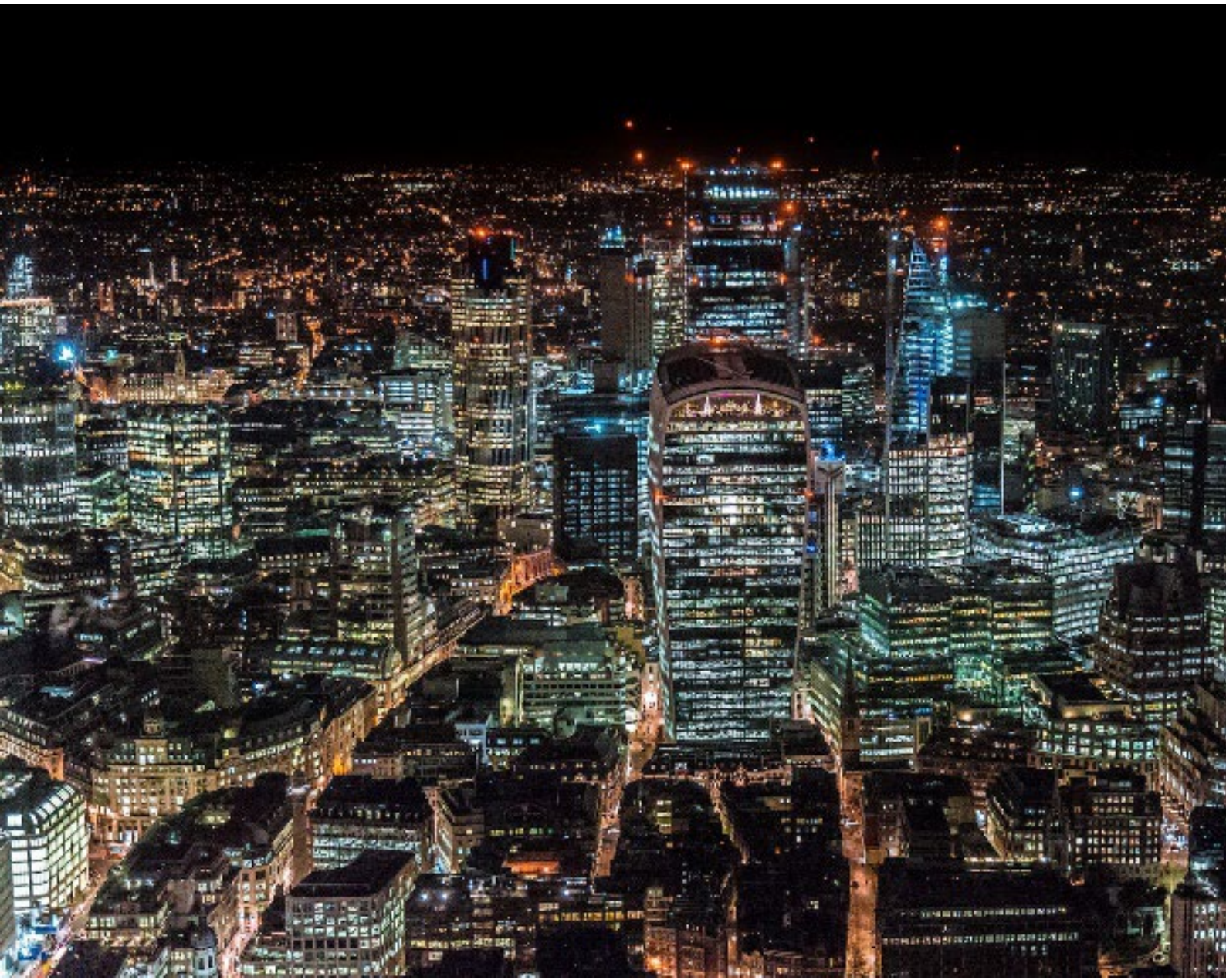
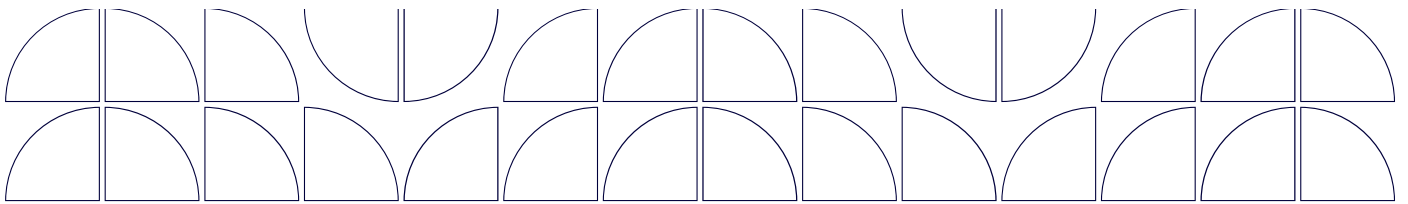


“Sunset and sunrise”: Offensive, exploratory, and defensive industry strategies in socio-technical energy transitions

Policy Brief

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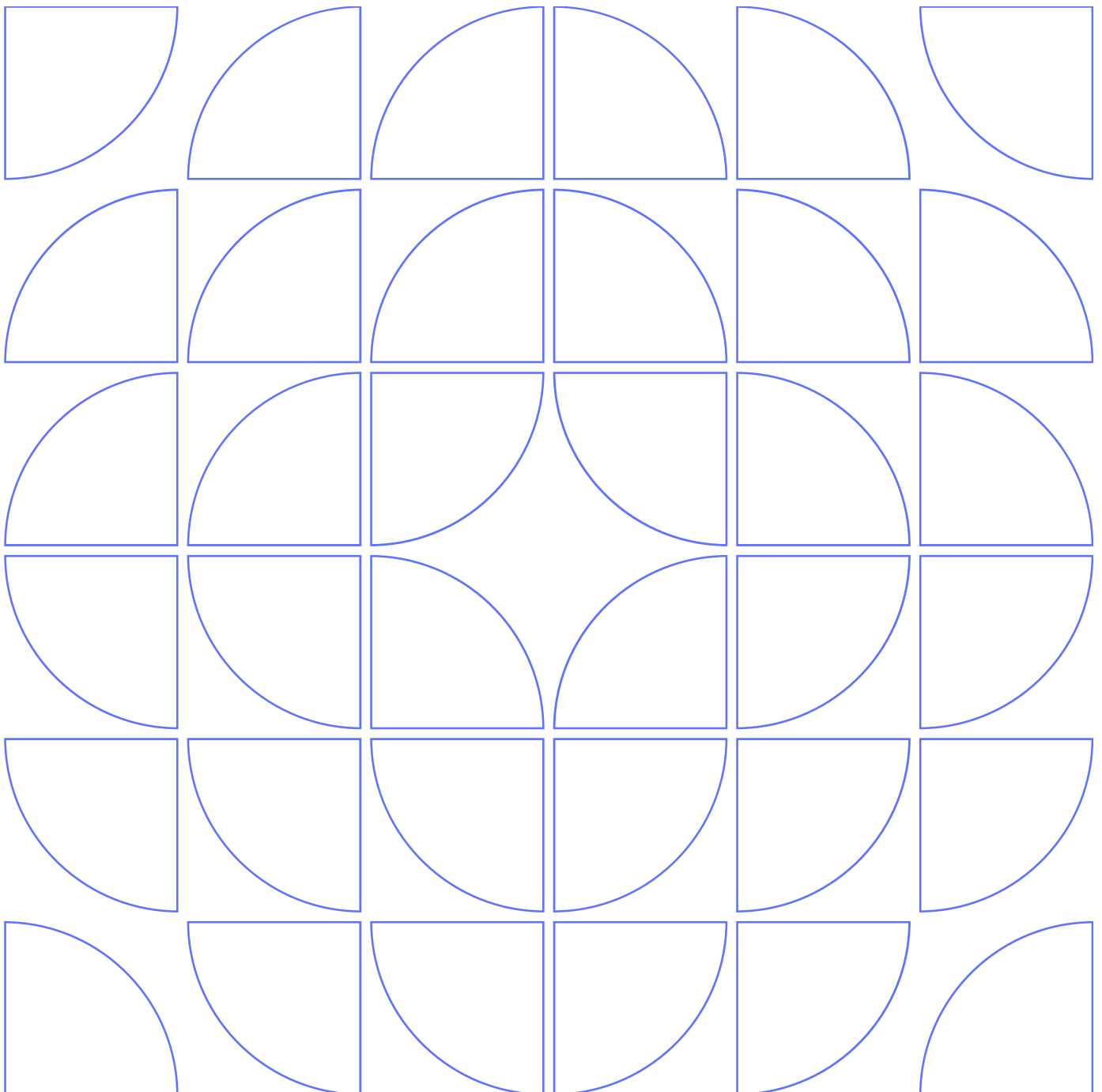


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Policy Brief: “Sunset and sunrise”: Offensive, exploratory, and defensive industry strategies in socio-technical energy transitions

Brunilde Verrier, Neil Strachan

Highlights

1. Industries have a crucial role to play in responding to, influencing, and enabling the socio-technical low-carbon energy transition
2. Incumbent “sunset” industries are sometimes portrayed as “locked-in” and structurally resistant, but research highlights the diversity of their strategies, which can evolve from defensive, to exploratory, through to offensive as leaders of change (Figure 1)
3. Research and policy attention is needed on the deliberate decline of carbon intensive technologies and practices
4. Industry and policy makers must seize the right window of opportunity to secure long-term benefits while minimising climate damage and transition costs
5. Industrial clusters are important sources of multi-stakeholder collaborative actions
6. Whole systems thinking, framing, narratives and system dynamics modelling are a key tool in helping industry navigate the energy transition

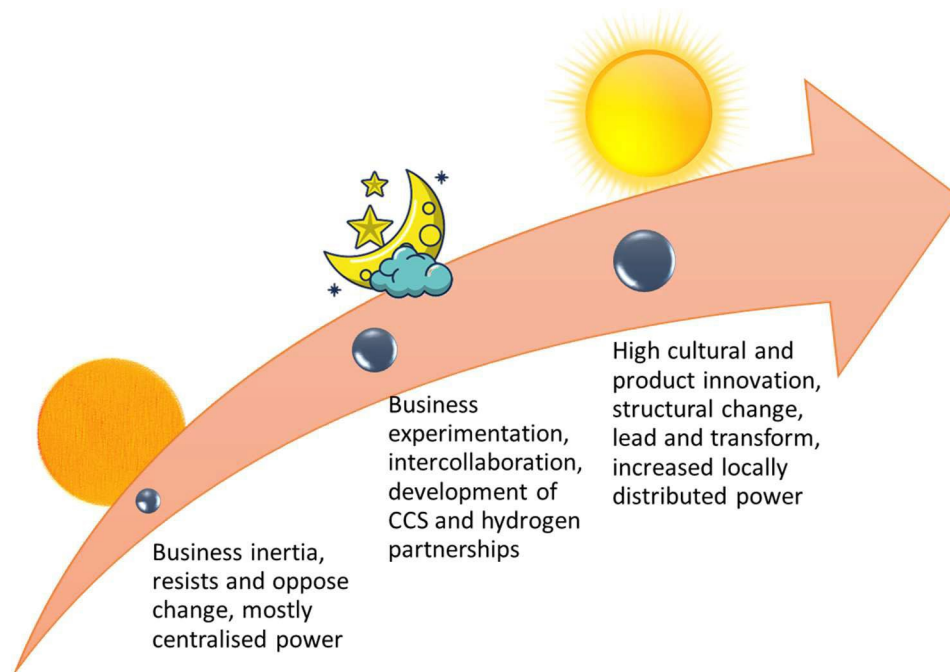


Figure 1: Evolutive strategies of sunset industries, adopting “moonlighting” and “sunrising” business models

l) The energy transition is a whole societal transformation in which industries have a core role to play

Through housing, heating, transportation, and the consumption of goods and services, energy is part of our livelihoods and underpins the structure of our societies, economies, and politics. In our quickly evolving, multi-faceted world, the transition to low-carbon energies will require incredible technical achievements as well as profound social and cultural transformations. Industries have a crucial role to play in enabling rapid transitions, strengthening energy resilience and security, and continuing to provide important socio-

economic benefits to the country. Exploring the tensions arising between different types of industries and corporate strategies, along with their connections to the wider socio-political landscape, can provide a better understanding of the system dynamics affecting the country's ability to reach industrial decarbonisation targets, hence reducing uncertainty and inform practical and efficient decision-making. Prominent transition frameworks call for a more comprehensive inclusion and representation of socio-political aspects and power dynamics to enrich our understanding of future energy transition pathways [1].

II) Industry types and strategies

1. Fundamental oppositions sunset versus sunrise

In any industrial transition, an elemental opposition can be drawn between “sunset” versus “sunrise” firms and their sectors. The first are commonly called “incumbents” or “declining” and the second “new entrants” or “emerging”. Sunrise industries are often understood as a business in its first stages of development, with high levels of technical and societal innovations, but low levels of networking coalitions. In the energy context, sunrising businesses are often linked to renewable energies, and despite rapid growth they are not yet seen as stable enough on the market to attract steady flows of finance [2]. By opposition, sunset industries are understood as well-established, highly consolidated firms and industries which start to lose investors interest due to changing market and socio-economic conditions. Incumbent industries are generally understood as strongly linked to fossil fuels and dominated by “multinationals and large state actors”, benefiting from high levels of political connections and stable flows of private and institutional investments for decades [2]. They are seen as having to cope with the decline of large flows of financial, human and infrastructures assets, to manage their “end-game” [3].

2. Incumbents transitioning strategies

Large energy industries have long been foundational to the historical socio-economic and political fabric of our societies, providing jobs and economic stability, and representing a very important national skill base. However, incumbency has also been portrayed as structurally resistant (“locked-in”) or even likely to slow or inhibit change. Transition research calls for more engagement with various forms of incumbency, highlighting the plurality of actor types and the variety of their strategies [4]. Even more importantly, the transient nature of industries’ strategic positioning over time means incumbents can adopt and evolve into different “sunsetting” and “sunrising” roles, from leading and supporting transitions, implement change imposed by regulations, through to mobilizing opposition to policies and new entrants (Figure 1).

Sunset industries transformational strategies in the face of changing landscapes and regulations can take three main shapes:

a. *Defensive*

Incumbents organisations tend to favour incremental change, which can render them vulnerable to the rapid emergence of new entrant’s solutions [5]. They are further liable to such destabilisations in case of technical and cultural lock-ins, or “business model inertia”, with slow responses reinforced by “initial denial or misinterpretation” of their position on the market [6]. The perception of their position eventually influences on business performance, as some organisations may delay core adaptation for too long, instead relying on defensive strategies such as downsizing or cost-cutting. If the need to reorganise is recognised only when risks and costs are too high, the ensuing reinforcing organisational and cultural resistance to change can ripple through wider transitions lock-ins and closed windows of opportunities [7]. If the company’s assets are tied to a particular industrial process or geographical location, their value will diminish even more rapidly, reinforcing already existing exit barriers and create further resistance due to effect on local jobs and economy. Similarly, when inertia is too entrenched, it often takes an external shock or crisis to shift strategies, which can arrive too late to sustain longer the industry [7].

It has also been argued that established firms sometimes resist, delay or reposition their contribution to transitions. For instance, some academic authors demonstrated that the heat sector in the UK does promote

a vision of “low-carbon gas”, and questioned whether incumbents have the power to shape transitions without necessarily providing benefits to the public [8]. Others found active resistance from coal, gas and nuclear industries to more renewable investment and deployment, instead repositioning themselves as heading towards carbon neutrality without fundamental transformation [9].

b. Exploratory innovation

Incumbent firms also engage in “moonlighting” transition strategies through new technologies and business models exploration that have elements of both sunrise and sunset firms and represent the re-orientation, experimentation, and potential re-invention of existing market players. As a specific industry transitions faster and deeper, the lines between sunrise and sunset firms can become more blurred [9, 10]. Business models such as interorganisational interactions and collaborations, even between competing firms, have been highlighted to enhance business viability and innovation.

These activities can gradually grow from individual incremental changes to an extension and introduction of parallel models, through to real disruption and full transformation [6]. Firms can be part of unified or diversified types of strategies within industrial sectors and supply chains.

While sunset and sunrise strategies often oppose fossil fuels to renewables, other technologies are playing a fundamental role. Large sunset industries are partnering with innovative new entrants

to develop tailored and efficient carbon capture and storage (CCS) or hydrogen technologies. The development of hydrogen and CCS is now widely recognised as necessary to help society transition to a low carbon economy and essential to reach UK national decarbonisation targets [11], and is currently attracting large research and investment efforts. Yet, if not developed as part of a comprehensive, “holistic” set of approaches, these technologies also have the potential to restrain the diffusion of renewables and delay the phase-out of carbon intensive fuels [9]. CCS technologies also come with energy intensive functioning requirements, which can be at odds with other emerging whole system transitions solutions such as demand reduction. However, the rapidity with which climate change is transforming our world does impose both behavioural change and “moonlighting” technologies together to be able to reach decarbonisation targets in time [12]. A recent European report on hydrogen also shows that opposing views can find common ground in solutions adapted to the needs of each sector [13].

c. Offensive and support for transformation

Many sunset firms choose to adopt strategies that are generally attributed to sunrise industries. These actors engage in active “green” business diversification and have powerful potential to support the transition and drive innovation [4]. They do not engage in less experimentation than rising start-ups, but rather pursue different models. For instance, incumbents tend to focus on environmental process innovation to save costs for consumers and emerging actors focus on green product innovation for niche eco-conscious consumers [14]. There is evidence of incumbents actively driving sustainability practices and supporting transformative change. Notably, sunset industries who recognise the opening of windows of opportunities to leverage their resources and capture value in niche sectors in domestic and international markets can contribute and benefit from transitions through a) technological innovation, b) knowledge and resources transfer, and c) enhancing the credibility of novel technologies, therefore offering market stability for investors [10]. Organisations actively engaging with sunrise strategies are more likely to manage efficiently and objectively the decline of their other assets and business models. For instance, national energy incumbents investing in renewables technologies may participate better in long-term national transition and secure their position on new markets while delaying the decline of their legacy assets [3].

III) Framing industrial evolution within socio-technical transitions

1. *Tensions between sunset and sunrise industry strategies are drivers of socio-economic destabilisation and risks to transitions*

Evolutionary economists and technology management scholars see disruptive technologies and sunrising agents as the driving factors for destabilisation or “creative destruction”, a process by which clusters of more productive and efficient technologies generate structural change and risks to economic and financial stability [15]. However, the sustainability and energy transition research strands see risks as focused on the sunseting organisations, mostly from depreciated and stranded assets (resources, technologies, finance, people and skills). Stranded assets linked to fossil fuels are of particular concern, due to the multi-level and profound links they have to their areas and local communities, which are liable to disturb wider local and national socio-economic stability and hence delay transitions.

Some authors describe the socio-economic destabilisation as jointly led by risks inherent to incumbents and the expansion of new entrants, such as assets valuation, debts and the creation of bubbles. Transition risk drivers such as mitigation policies, technology and preferences can impact the wider macro-economy through a chain of feedback causations reinforcing a cycle of high costs propagated via mechanisms of inflation, wealth inequality, and exchange rates [15].

Others warn that because the renewable industry remains to this day fragmented and operating on a single market, its rapid growth is not enough to secure high revenues, market capitalisation, and meeting investor’s criteria, in turn limiting steady investments and delaying transitions [2].

Additional financial barriers to the diffusion of low-carbon technologies come from the characteristics of energy intensive and high-capital expenditure industries such as steel, chemical or cement, where new technologies struggle to enter the commercialisation stage since investments carry uncertainty, longer paybacks and operational shutdowns to upgrade existing process and assets [16].

2. *Interactions between political capital and power generation*

Research gives growing attention to the political and coalitions conflicts dynamics of societal transitions. For instance, the energy transition creates tensions and interconnections between physical power generation and the balance of political power. Large-scale, centralised power production is often linked to fossil fuels and opposed to diversified, distributed systems often linked to renewables. In the UK, decentralised generation from households and community groups has recently grown as a developing niche market. While decentralisation is often seen as a threat to incumbents, energy firms could instead use it as an opportunity to develop new businesses [5].

Because of close relational networks between large businesses and senior policy-makers, many have denounced the potential lobbying influence of incumbents on governments, media and litigation to protect what is commonly termed “vested interests” [9]. While sunrising industries can struggle to enter the market and participate in networks of influence, incumbent regime actors in the UK have been observed to use several forms of power to resist climate related pressures to change [9].

Despite this resistance, small, new sunrising actors such as renewable energy communities (RECs) have recently gained limited capacity in shifting political centralized power structures. The government positioning on distribution and control of energy assets will determine the evolution of interconnections in energy system ownership and political power over time.

IV) Discussion

Deliberate decline of technologies and practices

Sunrising and sunseting industries are interacting within a broader set of socio-technical systems and sub-systems which are multi-level and co-evolutionary in nature [1]. The transformation is driven by landscape pressures (climate regulations, public concern, global threat) together with niche technologies, and creates disruption not only for incumbents but for the whole supply, demand and distribution system [10]. Academics propose that research and policy should engage more with the “deliberate decline” of both technologies and practices in carbon-intensive systems. Pivotal areas are the mechanisms of a) phase-out (rooted in policy regulations), b) divestment (rooted in civil and grassroot movements seeking to erode the position - and license to operate - of fossil fuels by asking important actors to divest their investments), and c) the destabilisation of regimes [17].

Windows of opportunity to secure long-term benefits

Industry and policy makers must seize the right window of opportunity to manage the transition while minimising climate damage and transition costs [15]. Structural change, innovations in low- carbon financing and incorporating investor considerations into policy design are needed, as well as international cooperation and coordination in prioritizing capital flows in developing countries [2]. Research studies emphasize the role of government policy and regulation in the acceptance and diffusion of new technologies, highlighting the government responsibility to set direction for innovation and financial investment that would diffuse new technologies in a “socially beneficial way” to manage economic instabilities arising from structural change. Leaders supporting transition policies may be perceived as more legitimate and even enjoy greater public support and political capital. Energy transitions and democracy can be mutually reinforcing if implemented together, as a distributed model can retain both local and shared broader economic benefits [18].

Industrial clusters are drivers of multi-stakeholder collaborations

In every major industrial cluster, important collaborations are ongoing between incumbents, new entrants and their local communities. Teesside, at the centre of the North Sea transition, is seen as an economic and political opportunity and one example where communities highly reliant on the oil and gas sector attempt to find balanced solutions. All parties recognize that conventional oil and gas production is increasingly uneconomic but wish to avoid local economic instability while maximising benefits for workers and the long-term resilience of the community [19].

The operationalisation of complex societal transitions and an industry-focused decarbonisation agenda can be brought about by linking corporate sustainability and environmental, social and governance (ESG) risks scrutiny via novel “whole-system” approaches. Next time, we will embody the industrial vectors of transformations presented in this brief within a System Dynamics framework to highlight bottlenecks and feedback loops of system change that can inform beneficial industry and policy action.

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