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Changing Energy Systems and Markets from the Ground Up – Citizens, Cooperatives, and Cities

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Abstract
This chapter provides an overview of the changing role of citizens, cooperatives and cities and the (non-)state actors they engage with in European energy systems. Where their changing role is driven by 'prosumerism', especially among citizens and cooperatives, we are witnessing demand shifting away from traditional supply structures. Where this is driven by intermediaries, especially in the context of local authorities and cities, we are witnessing a reduction in demand. A case study of energy scenarios in Great Britain provides an insight into the potentially transformative role of citizen, cooperative and city engagement vis-à-vis the competitive pressures of liberalized markets in shaping energy demand and supply. It concludes with insights into the knock-on effects of changing energy system and market arrangements around citizens, cooperative, and cities on energy politics and policy on the one hand, and energy trade and geopolitics on the multi-level governance of energy systems on the other.

Keywords: citizens, cooperatives, cities, governance, ground-up

1. Introduction

Historically, fossil energy and mobility systems evolved into interlinked yet independently regulated centralized 'industry regimes' supported by national policies embedded in science, technology and innovation systems that operate at national and transnational scales (Turnheim and Geels, 2012; Geels, 2014; Lockwood et al., 2019). Traditional geopolitics was synonymous with this 'industry regime' of fossil fuels, especially oil and gas (O'Sullivan et al., 2017; Scholten et al., 2020). Associated energy markets are characterized by predefined groups of passive consumers, distinct suppliers and innovating experts with siloed policy maintaining industry codes, safety standards and security of supply. Nuclear power takes this to an entirely different level through its geopolitical clout and the strict separation of experts, shrouded by military-industrial secrecy, and passive, uninformed consumers (Smith, 2014; Johnstone and Stirling, 2020).

Despite such path-dependent characteristics, these systems are undergoing change. In the electricity sector it is evident that the centralized 'industry regime' is being challenged by increasingly renewable and decentralized systems (Burger et al., 2020). This transition is driven by decades of subsidies, which have grown the economic competitiveness of renewable energy technologies, attempts to factor in externalities of burning fossil fuels through carbon pricing, as well as socio-technical change driven by rapid advancements in technologies (Ives et al. 2021). To date, the winners of this transition include wind and solar power developers, often utilities, who can generate at scale using existing transmission and distribution infrastructures (Judson et al., 2020).

At the same time, we are witnessing a diversification of non-state actors engaging in energy markets who engender significant potential to alter fundamental energy system characteristics. Citizens, cooperatives and cities are challenging the status quo through the spatial reorganization of governance arrangements, business models, skills, control and infrastructures at a regional and local level in energy generation, storage, demand reduction and management and the provision of ancillary services (Webb et al., 2016; Brown et al., 2019; Heldeweg and Saintier, 2020; Nolden et al., 2020; Scholten et al., 2020; Wittmayer et al., 2020; Berthod et al., 2022).

Following Russia's invasion of the Ukraine, energy security and geopolitics have once again moved center stage (IEA, 2022). The consequential prioritization of supply security has in many cases been accompanied by the nationalization of energy supply companies and infrastructures. While this trend is putting decentralization of such governance arrangements into question, the increasing realization that decarbonization hinges upon the engagement of citizens at the point of demand through multi-level governance is solidifying their recognition as demand-side actors (Tingey and Webb, 2020; IPCC, 2022).

Decoupling energy demand from economic activity (reduction of the energy intensity by improving efficiency) has been the main driver of carbon emission reductions to date (IPCC, 2014), and accounts for 40-70% of the emission reductions we need to limit global warming to 2 degrees above pre-industrial level (IPCC, 2022). By downscaling energy systems, energy demand reductions facilitate rapid decarbonization and system transformation (Grubler et al., 2018). Understanding the role of citizens, cooperatives and cities, and the multi-level governance necessary to harness their full potential in the emergent energy geopolitics, will increase in importance if commitments to decarbonize will be honored.

This chapter analyses the role of citizens, cooperative and cities in shaping energy system characteristics, governance and markets from the ground up through innovative institutional arrangements, business models and routes to market. Section 2 discusses different profiles of energy supply technologies before introducing a framework developed by Heldeweg (2017) and evolved by Heldeweg and Saintier (2020) and Wittmayer et al. (2020) to help conceptualize the changing role of citizens, cooperatives and cities in energy systems and market structures. Drawing on this framework, Section 3 analyses their changing role like a Russian doll, starting with the prosumer as the individualized challenger of energy systems and markets before moving on to cooperatives, community initiatives and platforms before discussing the changing role of cities and local authorities in energy supply and demand. It subsequently uses the case study of Great Britain to provide an insight into the potentially transformative engagement of citizens, cooperatives and cities vis-à-vis the competing pressures of liberalized markets and energy security concerns in shaping energy demand and supply. Section 4 provides insights into electricity market and (geo)political consequences of citizens, cooperatives and cities challenging governance arrangements, market structures and business models. Section 5 discusses on the implications thereof in the context of energy politics and policy as well as the geopolitics of energy supply and demand. This chapter concludes in Section 6.

2. The changing role of citizens, cooperatives and cities in energy systems and markets

To understand the cultural implications of this change, this section compares the risk profile of generation technologies and explores their relationship to the 'institutional nexus' of sustainable energy. It subsequently analyses the often undervalued and poorly understood role of energy demand reduction efforts in reducing carbon emissions and progressing towards the sustainable development goals.

2.1. The institutional nexus of energy supply

Current electricity generation technologies are characterized by three dominant risk and life-cycle cost profiles regarding build-up, operation and build-back of generation plants (profiles 1-3 below). Build-up includes everything from feasibility studies to arranging transmission and distribution and constructing the generation plant. Operation includes the functions, duties and labor associated with day-to-day activities to ensure that systems and equipment perform their intended function, including operation, maintenance and fuel supply. Build-down includes decommissioning, deconstruction, demolition and disposal.

One risk and life-cycle cost profile requires de-risking and financial outlay mainly for operation, but less so for build-up and build-back (Profile 1; see Table 1). Most fossil fuels fall into this category, as well as dispatchable renewable energy sources such as electricity and heat generation using biomass. Another requires de-risking and financial outlay mainly for build-up and build-back, with strong regulatory systems necessary to ensure smooth operation associated with nuclear power (Profile 2; see Table 1). The final one requires de-risking and financial outlay for build-up and operation, with an emphasis on the former and the latter dependent on an energy system's capacity to smoothen out fluctuating load profiles. This applies to many renewable energy technologies such as wind and solar (Profile 3; see Table 1).

	Build-up	**Operation**	**Build-back**
Profile 1	+	+++	++
Profile 2	++	+	+++
Profile 3	+++	++	+

Table 1: Dominant risk and life-cycle costs of generation plants.

Profile 1 applies mainly to tradition baseload power stations such as coal-fired plants involving relatively low capital expenditure per kWh and high, sometimes fluctuating, marginal costs. It emerged out of both constitutional orders (nation states) and competitive markets (see Figure 1). The latter requires high capital expenditure and hinges upon consensual exchange in pursuit of private interest in a competitive context, checked and balanced through consumer protection and competition (Heldeweg, 2017; Heldeweg and Saintier, 2020). This risk and life-cycle cost profile emerged with the age of production in the 19th century where supply chains were developed and needs were satisfied on a large scale (Lord, 2014; Smil, 2017).

Profile 2 involves very high capital expenditure per kWh and low marginal costs. This applies to nuclear energy which is most economically run at very large scale and requires support, intervention and organization by constitutional orders (states) to de-risk (military-)industrial nuclear fuel supply, reprocessing, waste storage and decommissioning (Smith, 2014; Johnstone and Stirling, 2020). Constitutional orders in this case determine the public interest and pursue this interest unilaterally and hierarchically through powers of command and control, checked and balanced through the separation of power (see Figure 1; Heldeweg, 2017; Heldeweg and Saintier, 2020). This category only became economically viable when demand became codified and consumption conspicuous in the 20th century (Lord, 2014; Smil 2017).

Profile 3 is associated with renewable energy sources such as solar and wind power and involves high capital expenditure per kWh and relatively low marginal costs, although this depends on the resources required to balance intermittency. It emerged out of civil network innovation, especially in countries such as Denmark, and diffused through technological forcing in heavily subsidized markets supported by constitutional orders, often using feed-in tariffs, with increasing support by civil networks (see Figure 1; Nolden et al., 2020). The latter are checked and balanced through safeguards for social inclusion and non-discrimination of not-for-profit services (Heldeweg, 2017; Heldeweg and Saintier, 2020). Lord (2014, p. xii) argues that because renewables were "born of an awareness of potential or actual scarcity" they have the potential to lead us back to abundance through a culture of stewardship. Renewables facilitate change by providing new opportunities for non-traditional actors, especially civil networks, beyond constitutional orders and competitive markets through scalable decentralization vis-a-vis static and centralized fossil fuel and nuclear energy (see Figure 1; Burger et al., 2020; Heldeweg and Saintier, 2020; Nolden et al., 2020). Together, they shape the institutional nexus of sustainable energy:

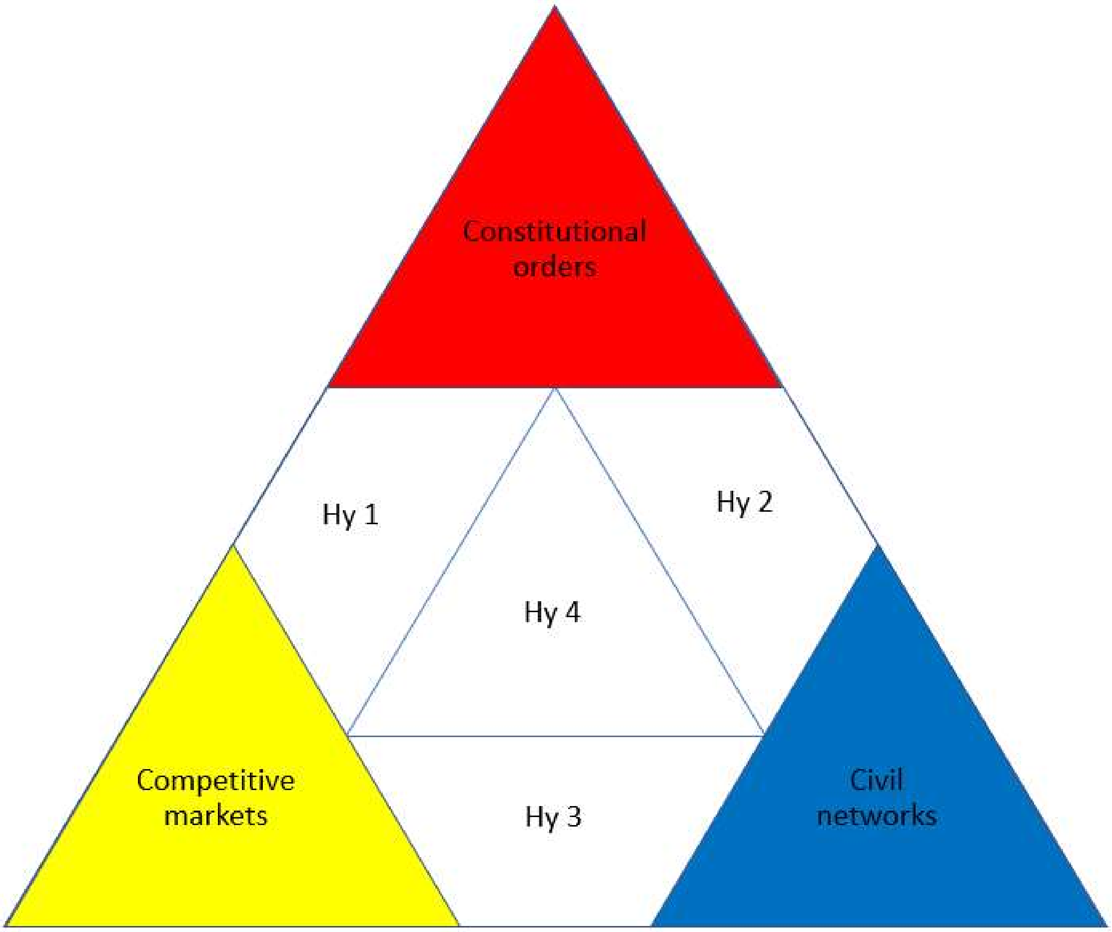

Figure 1: The institutional nexus of sustainable energy (adapted from Heldeweg, 2017).

Civil network engagement in sustainable energy supply depends on collaborative and sharing relationships in pursuit of social and community interests. Increasingly, they are challenging energy systems and markets from the ground up. Cultural change from production and consumption, inherent in fossil fuel and nuclear supply with their associated risk profiles, towards prosumtion and stewardship, inherent in renewables and their associated risk profile, coincides with new roles and responsibilities for civil network actors. While their effect on energy systems and markets has been negligible to date, especially on the supply side, this underlying cultural change is emerging as a significant driver for changing demand, supply and geopolitical implications (Lord, 2014).

2.2. Changing market structures of energy demand

Fossil energy and nuclear systems (profile 1 and 2) are associated with three distinct market structures: one around feedstocks and fuels, one around generation technologies and one around wholesale electricity markets. In contrast, renewable energy systems such as wind and solar (profile

3) require few, if any, feedstock and fuels. Other renewable energy systems, such as biomass (profile 1), are driving the emergence of new feedstock and fuel markets derived from vegetal labor (Palmer, 2021). Overall, a shift is underway from energy sources and carriers (profile 1 and 2) towards generation technologies and energy services (profile 3; see also Scholten et al., 2020).

If this entails a shift from long-term deals that secure supply towards intraday markets to manage intermittency market design, regulation and energy policy practices need to change accordingly. On a global scale, however, the market share of renewables is still very small and it is not a strategic factor in the geopolitics of energy (Scholten et al., 2020). This has been painfully evident in the European response to Russia's invasion of the Ukraine, which focuses nearly entirely on securing the supply of fossil fuels (IEA, 2022). Nevertheless, the increasing 'domestic orientation', which has been amplified by increasing geopolitical tension, is driving the revival of domestic production capacities in many countries as the make-or-buy decision appears to be tilting towards the former, as increasingly expressed in industrial policies centered on inshoring (Freeman, 2018).

Market structures to reduce energy demand, on the other hand, are exclusively domestic but their implications for geopolitics can be as far-reaching as markets changing through the supply transition to renewable energy. Creating revenues from energy demand reductions requires similarly sophisticated, and sometimes even more complex institutional arrangements, market structures and business models as those for renewable energy technologies with high capital expenditure per kW and relatively low marginal costs per kWh. However, such market structures tend to place greater emphasis on operational expenditure (OPEX) than capital expenditure (CAPEX), especially where the CAPEX of energy demand reduction measures is paid for through a share of the reduced OPEX, as is the case in energy service and performance contracting markets (Sorrell, 2007).

Such markets benefit from intermediaries to reduce transaction costs associated with their contractual arrangements (Nolden et al., 2016). Targeted intermediation through technical assistance by the European Investment Bank for example has delivered a return on investment of 37:1 (EIB, 2019; Tingey and Webb, 2020). Associated energy demand reduction, and the consequently reduction in size of the energy system, represents the most cost-effective, timely, and lowest-risk option to decarbonise (Barrett et al., 2022). Reducing energy demand, compared to decarbonizing supply, is also associated with many more synergies than trade-offs regarding the achievement of the Sustainable Development Goals and "consistent with improving basic wellbeing for all" (IPCC 2022).

At the intersection of demand and supply lie interventions which combine targeted energy demand reduction interventions with local renewable energy supply. These are driven by an ever-increasing diversity of ‘prosumer’ business models and intermediaries (Brown et al., 2019). Whether in combination with solar home systems, micro or nano grids, we are nevertheless their application in urban settings alongside more traditional remote rural locations (Kennedy et al., 2019).

3. Challenging energy systems from the ground up

The following sections analyze the roles of citizens, cooperatives, social enterprises, local authorities and cities in shaping the energy transition from the bottom up. Particular emphasis is placed upon institutional arrangements, market structures and business models regarding both energy supply and demand.

3.1 The role of citizens, cooperatives and cities

While changes in energy supply structures are more visible and obvious, energy demand reductions, through non-industrial energy efficiency improvements and avoidance, are highly diffused, often invisible and best understood as a ‘bottom-up’ business. Although national supportive policy is crucial, the implementation of energy demand reduction measures is highly dependent on local initiatives at city or local authority level as well as individual and cooperative action (Grubb et al., 2014, p. 161).

3.1.1. Citizens

With an increasing share of electricity generated on domestic properties, and changing institutional arrangements, market structures and business models increasingly also facilitating buy-into the energy transition among those without property, prosumerism has come to epitomize citizen engagement in energy systems. Initially supported by rich-world subsidies such as feed-in tariffs, declining subsidies have made financial viability of solar home systems increasingly dependent on maximizing self-consumption (Nolden, 2015; McKenna et al., 2018).

With increasing energy prices due to geopolitical uncertainty, it is becoming increasingly economically viable to install such systems without subsidies (Brown et al., 2019; Nolden et al., 2020; Ives et al., 2021). From a grid perspective, such systems are nevertheless associated with ‘uncontrollable’ outflows of electricity. However, in combination with smart meters and storage such outflow can be converted into a grid resource. This implies that owners of solar home systems combined with batteries and smart meters can choose to supply the electricity market where previously, without such systems, they only demanded and were supplied with electricity. Under a

Peer-to-Peer (P2P) energy trading scenario, prosumers might take control over where the electricity flows to by creating provenance through meter data (Schneiders et al., 2022).

In combination with energy demand reduction measures, such as insulation and the switch from fossil fuel heating to electric heating (which are associated with efficiency increases from 80-90% to 300-350%), such systems can significantly decrease the dependency of grid supply electricity. Given the abovementioned importance of energy demand reduction measures for limiting climate change, it is pertinent to combine increasingly economic domestic supply opportunities with demand reduction measures. For citizens, this change from fuel purchaser to asset ownership creates a possibility of breaking the energy-work nexus. It embodies alternative values beyond production and consumption which ”free energy from the bindings of exploitative work” (New Daggett, 2018, p. 12).

However, the combination of lower energy demand with hybrid systems combining solar home systems combined with batteries and smart meters can also encourage grid defection. This occurs when those who can afford to do so reduce and shift their energy demand from grids towards self-generated power, usually electricity. The more power is generated and managed beyond the scope of policy and taxation, the more those who cannot afford such systems pay for the maintenance of the gird, which can undermine the democratic accountability of energy political decision-making (Nolden, 2019).

Such solutions might be more appropriate in other contexts, especially where solar home systems closely follow demand curves of cooling technologies, such as air conditioning. In practice, however, certain local and national factors may prevent their adoption. In South Africa, for example, decentralized/distributed energy sources are associated with poverty because only white settlements were connected to the grid during Apartheid while the black townships relied on other sources. The result is that there is a strong cultural drive towards (coal fired) grid electricity (Personal communication, 2018).

3.1.2. Cooperatives

Emergent institutional arrangements, market structures and business models concerning civil networks are an indirect consequence of changes to how labor and markets were organized from the 1980s onwards. In the energy sector, this change coincided with a politically motivated desire to increase the share of renewable energy technologies, especially from the 1990s onwards. Generous subsidies and their inherent scalability have diversified the energy supply landscape and the operation of electricity grids (Burger et al., 2020; Schneiders et al., 2022).

Government backing of such payments implied that renewable energy developers took on project risk but not revenue risk. Such guarantees also de-risked the build-up of generation plants (see Profile 1 above) by providing predictable cash flows and lowering transaction costs (Nolden et al., 2020). In Europe in particular, tariff banding among feed-in tariffs countering economies of scale led to a proliferation of non-traditional organizations engaging in energy supply arrangements, ranging from charities to social enterprises (Bauwens et al., 2016).

Following the termination of such market-based mechanisms, associated business models are shifting towards establishing routes to market for both supply and demand side solutions. Such routes to market on the supply side rely on the sale of electricity, either to an electricity supplier or organizations directly through Power Purchase Agreements (PPAs), to overcome revenue risk associated with exposure to the wholesale market. Such PPAs reduce such risk by creating a stable, long-term revenue stream which provide the basis for investment (Nolden et al. 2020).

On the energy demand side, cooperative and social enterprise engagement in Europe in particular has focused primarily on energy poverty alleviation. With rising energy prices and the complexity of PPAs discouraging supply arrangements, the focus is increasingly shifting towards flexibility and demand reduction business models. Rather than treading flexibility as an individual household responsibility, cooperative business models enable pooling to provide a vital power system resource (Yule-Bennett and Sunderland, 2022). Regarding demand reduction, cooperatives have a crucial trusted intermediary role to play between energy service providers, financiers and households (Nolden et al., 2016; Braunholtz-Speight et al., 2021).

In general, it is increasingly recognized that non-profit intermediaries have a crucial role to play between citizens, local authorities and national energy policy (Nolden et al., 2016; Nolden et al., 2020; Tingey and Webb, 2020; Braunholtz-Speight et al., 2021). Engagement is crucial to both reduce transaction costs of energy service provision and establish trusted communication channels regarding options and benefits of increasing engagement in the energy system transition towards zero carbon.

3.1.3. Cities

Cities rank among the most ”stark illustrations of the evolutionary and path-dependent nature of our system” (Grubb et al., 2014, p. 379). At the same time, they represent arenas where ‘industry regimes’ associated with constitutional orders and competitive markets predominantly interact with ‘grid-edge’ civil networks. As a result, cities are increasingly considered the ‘interface’ where solutions to overarching sustainability and climate change issues are likely to emerge and take effect (Broto and Bulkeley, 2013; UNFCCC, 2015; Reckien et al., 2018). Cities already host over 50% of the global population, account for about two-thirds of primary energy demand, emit 70% of total energy-related CO_2 emissions and account for about 80% of the world's Gross Domestic Product (Reckien et al., 2018; UNEP, 2019).

In recent years, many local authorities have responded to the climate crisis with the declaration of climate and ecological emergencies. These often involve zero carbon targets before 2050 and ambitions for inclusive economies which require significant societal shifts and transitions to new ways of living and working (Tingey and Webb, 2020). As a result, local authorities in charge of city and regional governance have the potential to act as powerful intermediaries in energy transitions, similar to cooperatives but at a much greater scale, if they have the mandates, capacities and skills to coordinate interaction (Kuzemko and Britton, 2020).

As energy supply, and electricity supply in particular, is usually of strategic importance and consequently the remit of national energy policy, cities have a disproportionate role to play in governing the reduction of energy demand. Thanks to a certain degree of responsibility over housing and transport, their influence on energy systems is often indirectly through the fabric and geography of urban form (Barr et al., 2018). They often share direct control, if not ownership, over public-sector property, such as buildings, street lighting, or vehicles, which provides opportunities to encourage more sustainable usage patterns and implement innovative technologies, business models and governance arrangements in relation to mobility, local energy networks and buildings (Kuzemko and Britton, 2020; Tingey and Webb, 2020).

Some cities may also be directly or indirectly involved in the provision of utility services such as water and waste removal alongside energy services and in their role as public procurers they can specify environmental and social criteria alongside economic priorities in their provision (Uyarra et al., 2014). Other cities may act as metropolitan leaders for inter-municipal initiatives, which may include technical infrastructure or transport provision that transcends city borders. Cities may also encourage citizen-led innovation by providing appropriate governance frameworks (Bulkeley and Betsill, 2003; Broto and Bulkeley, 2013; Reckien et al., 2018).

Cities are also increasingly the focal point of transformative change and increasingly provide the institutional framework for low-carbon experimentation (Webb et al., 2016; Kronsell and Mukhtar-Landgren, 2018). Governments as well as supranational bodies such as the EU are actively providing funding and support for cities to engage in innovative low-carbon experiments, projects and demonstrations through collaborative development and knowledge exchange.

On the other hand, cities, like countries, face a unique set of challenges. In emerging economies, many cities are experiencing rapid planned and unplanned expansions with public services barely able to keep up. In rich countries, cities are aging unevenly with differentiation already evident between as well as within countries. What they tend to have in common is lack of access to finance and restrictive budgeting cycles, which tend to conflict with long-term developments and planning horizons required for deep socio-ecological transformation (Bulkeley and Betsill, 2003).

Other issues relate to the lack of skills and capacities among many local authorities to engage with the long-term governance required to tackle intergenerational issues, especially regarding legitimization by the local population (While et al., 2004; Martin et al. 2019). Where cities carry educational responsibilities, the lack of in-house energy transition skills can have cascading knock-on effects on the entire skill structure among the local population (Chitchyan and Bird, 2021).

3.2. Citizen, cooperative and city engagement in liberalized electricity markets

Since the liberalization of electricity markets in many European countries, civil networks in the form of citizens, cooperatives and cities predominantly feature as consumers (see bottom right of Figure 2 below), despite their importance in shaping energy demand and human interaction with supply and energy system change (see Section 3.1 above). The institutional environment of electricity supply, in contrast, has been dominated by utilities (orange dot) regulated (red arrow) by constitutional orders (relevant government energy departments and ministries, regulators, transmission grid operators and industry code panels) (Heldeweg, 2017; Heldeweg and Saintier, 2020). Utilities operating in such highly regulated supply markets sell power (orange arrows) to organisations representing constitutional orders (government, local authorities, government owned organisations), competitive markets (industry, services) and organisations and individuals (consumers) that make up civil networks (NGOs, charities, cooperatives, social enterprises and citizens). In more liberal markets, prices are set by utilities while in more heavily regulated markets, prices are set by the regulator, with the emphasis shifting towards the latter as a result of Russia's invasion of the Ukraine.

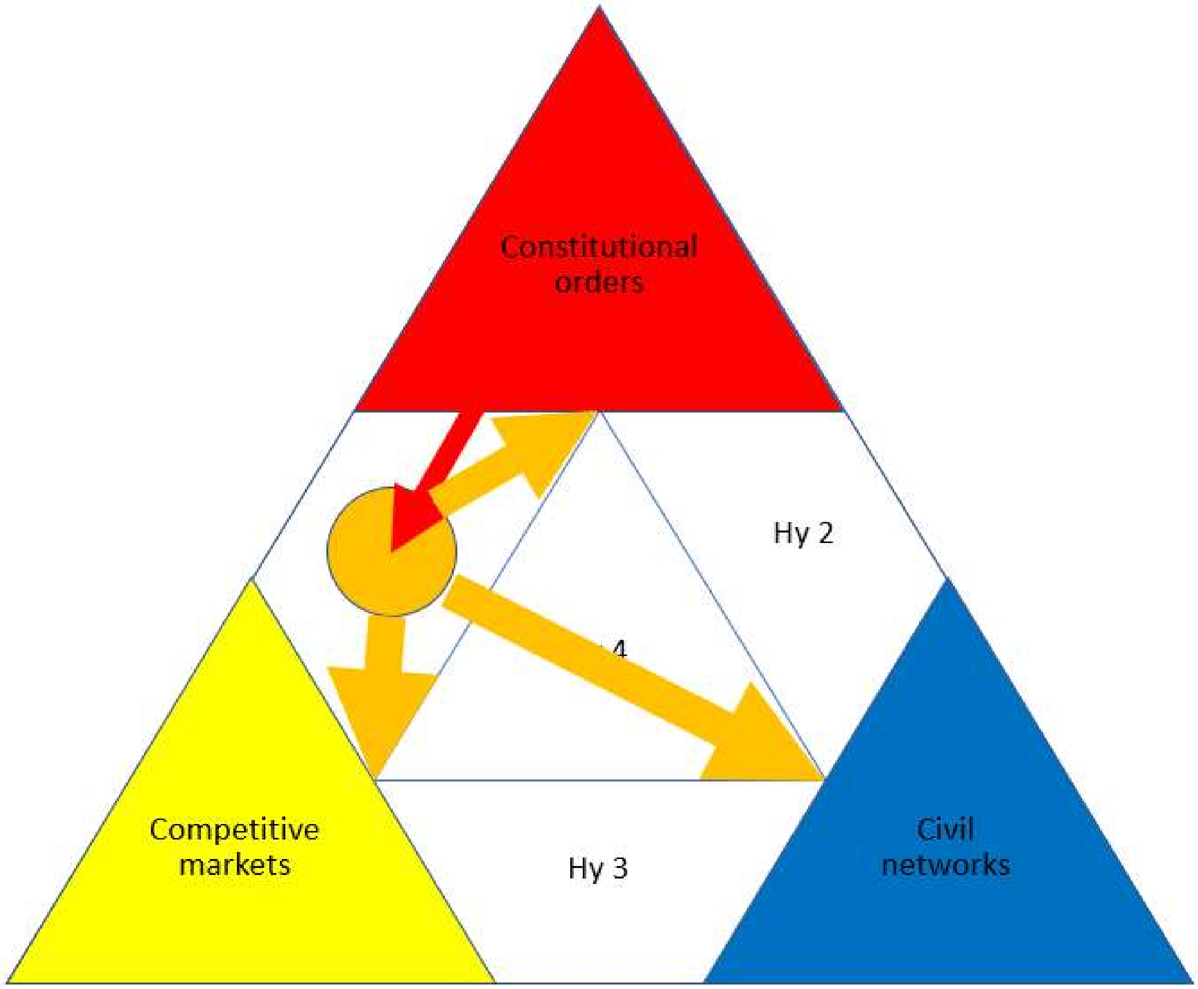

Figure 2: The institutional nexus of liberalized electricity markets (adapted from Heldeweg, 2017).

In more liberalised markets, regulatory frameworks over time have simplified the contractual process of changing supplier for consumers on the demand side and the establishment of long-term supply contracts for organisations with large electricity demands. But the relationship between such consumers and energy systems is changing, not least a result of the cost-of-living crisis and mounting energy security concerns (Nolden et al., 2022).

3.2.1. Conventional supply arrangements vs. societal engagement – a case study of Great Britain

The following case study of Great Britain serves to highlight how non-state actors such as citizen-led initiatives, often institutionalized around cooperatives and social enterprises, as well as cities, usually through local authorities who lie at the intersection between civil networks and competitive markets, can contribute significantly to the diversification of electricity markets. This is particularly evident in the context of socio-technical change around demand reduction and decentralized electricity supply from renewable sources.

Increasingly, this is also recognized by a wide range of organizations, including electricity grid operators, such as Britain's transmission grid operator National Grid. Among the multiple decarbonization scenarios it has modelled, those that maximize civil network engagement, either as consumers or citizens, and socio-technical solutions foresee the lowest electricity demand (and energy demand more generally) and the highest uptake of distributed demand and supply solution). Scenarios that assume low public engagement and emphasis on technological solutions driven by competitive markets, in contrast, foresee lower uptake of distributed solutions and much higher electricity demand (National Grid, 2020).

The technological substitution of fossil powered end-use energy demand technologies with low-carbon alternatives therefore rests upon a willing citizenry to adopt them and lifestyle changes through greater engagement, empowerment and facilitation. Cooperatives and cities can be considered essential intermediaries which enable such a transformation through citizen engagement. Pursuing National Grid scenarios with high public engagement could lead to an energy system with an annual end consumer energy demand in 2050 of around 600TWh (Consumer Transformation and Leading the Way scenarios) compared to around 900TWh for the technological fix scenario (System Transformation). In 2019, annual end consumer energy demand sted at just over 1,400TWh.

Crucially, around 400TWh of the demand projected Consumer Transformation and Leading the Way scenarios is expected to be supplied through electricity. This will require a huge increase in electricity supply but the scalability of electricity generation technologies suggests that civil networks, including citizens and cooperatives, and constitutional orders, including cities and local authorities, can and will play a more significant role in the provision of electricity compared to more path-dependent scenarios. By combining environmental and social objectives with an economic one often based on the reduction of energy 'leakage', citizens, cooperatives and cities seek to ensure revenue recycling by retaining upfront investment and returns within a local economy. Their engagement thus constitutes a driver of changes to energy system characteristics and interstate relations.

4. Broader market and geo(political) implications

Although the combined impact of citizens, cooperatives and cities vis-à-vis strategic energy supply decisions at national level shaping fossil energy supply chains might appear negligible, their impact on energy markets over time is profound, especially regarding market structure, business models, and welfare considerations (Kuzemko, 2019). This is slowly having knock-on effects on energy systems characterized by path-dependencies and burdened with legacy infrastructure. This section reflects upon the implications thereof. While direct effects on interstate energy relations might be difficult to trace or directly attribute, they play a role in the overall geopolitical shift induced by the transition to renewable energy.

4.1. Effects on energy policy and politics

Rapid changes to energy systems and associated competitive markets regulated by constitutional orders require a rethink of energy market design, especially in the context of energy security challenges and a cost-of-living crisis. What most commentators agree on is that an increasingly diverse range of actors will engage in multiple ways in managing demand and supply across time and space. What they cannot agree on is the nature of engagement.

If we conceptualize people as citizens, cooperatives as the means for citizens to engage in energy systems and markets without bowing to competitive pressures, and cities as arenas where such engagement can be scaled-up and replicated, we can conceptualize risk minimization in build up (Profile 3) the context for creating alternative value and values to those imposed by competitive markets. This perspective supports the provision of patient capital and embedded business models which create social and environmental value and deliver multiple benefits while reducing financial leakage (Tingey and Webb, 2020). Under such a scenario both locally procured and institutionally provided patient capital supporting engaging business models will shift energy demand from competitive markets towards both constitutional orders and civil networks through demand reduction and prosumtion.

The greater the number of active market participants, however, the greater the challenge of system integration, maintaining stable grid voltage and frequency, and associated institutional arrangements (Nolden, 2019). On the other hand, more distributed supply and demand management capabilities might enhance overall resilience through spatial and scalar diversity of such capabilities, especially when faced with increasing natural or political security threats. If this is considered desirable, constitutional orders, through energy policy and politics, should facilitate place-based approaches which manage supply and demand across vectors. The challenge lies in ensuring that opportunities do not favor affluent and well-educated citizens and associated cooperatives or particular cities to the detriment of those unwilling or unable to exploit them. Institutional governance arrangements therefore need to ensure that business model innovation and market structures deliver just transitions across administrative boundaries and jurisdictions.

4.2. Effects on energy trade and geopolitics

The question is how this translates into energy trade and geopolitics. It is obvious that integrated energy systems accommodating millions of citizens as increasingly interconnected prosumers, in empowered cooperatives or supported through city and local authority intermediation, would send different demand and supply signals compared to liberalized (albeit heavily regulated) power markets with a couple of hundred major players. Judging by the scenarios developed by National Grid for Great Britain, total energy demand could be reduced by around a third without significant citizen engagement and by more than half with full citizen engagement and lifestyle changes (National Grid, 2020). As most of this demand would be covered by electricity, a significant share of which would be supplied domestically, the amount of imported energy especially in the form of fossil fuels, would be drastically reduced. Bioenergy demand and vegetal labor would replace fossil fuels as the main imported dispatchable energy source and natural resource extraction and subsequent embedding in the supply chains of low and zero-carbon technology would replace fossil fuel extraction, both associated with different but very significant social and environmental degradation, conflict and tension (see UNEP, 2019; Palmer, 2021).

Supply chain congestions in the wake of the Covid-19 pandemic and Russia's invasion of the Ukraine suggests that this substitution process is far from certain. On the other hand, the conventional approach, which assigned risk among actors with the largest balance sheets, and succeeded in doing so by expanding and diversifying commodity supply chains, is being challenged by a much wider range of considerations, ranging from concerns about climate change to the unease about cementing dependencies on autocratic petrostates. This significantly complicates the make-or-buy decision as the inshoring of entire supply chains is likely to result in much higher overall costs but increased energy security. It might be price worth paying in light of increasingly evident negative consequences of climate change and fossil fuel import dependencies.

5. Discussion

To sum up, there are two dimensions to citizens, cooperatives and cities changing energy systems and markets from the ground up in the context of this Handbook: i) a domestic dimension with sectoral and institutional consequences and ii) geopolitical dimension with energy policy consequences for trade and politics. The domestic dimension is characterized by the slow but steady reorganization of energy supply around increasingly decentralized and flexible technologies, business models and engagement frameworks on the one hand, and reductions in energy demand driven by local authorities and cities lacking the strategic capacity to significantly alter supply arrangements on the other. The geopolitical dimension is characterized by the slow but steady reorganization of supply chains to support this decentralization tendency and the politicization thereof. This is a result of increasing public (and business interest) interest in social and environmental dimensions of energy systems from well-to-wheel, from cradle-to-grave and from farm-to-fork, and knee-jerk reorganization as a result of energy security concerns.

However, this chapter also stresses the highly heterogenous nature of these dimensions. While national energy systems and markets are considered strategic priorities, the actions of citizens, cooperatives and cities have mostly contributed to the spatially and temporally highly variable complication of supply and demand structures from a grid management or global supply chain perspective, rather than their disruption. If this were to change, energy policy and politics will need to pay more attention to changes arising from the ground-up. If lower energy demand and the benefits of decarbonizing smaller energy systems was to become a strategic energy transition priority, for example as a result of sustained geopolitical tension, such attention will necessarily move center stage (see Barrett et al., 2022).

6. Conclusion

While constitutional orders and competitive markets are active agents in the transition of energy systems, citizens, cooperative and cities, and civil networks in general, play a more passive role. However, the latter are often part of other networks and institutions that span borders and continents, which can be harnessed to accelerate more decentralized aspects of this transition. The greater the involvement of citizens, cooperatives and cities in energy supply and demand decision-making, the greater the effect on institutional arrangements, market structures and business models, and ultimately energy security. A more human-focused energy system could be the result with much greater potential for energy demand reduction and integrated solutions. The consequences for the geopolitics of energy could be as profound as the shift from fossil fuels to natural resources.

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