Persistent problems of polycentric governance as a tool for improving UK energy system governance

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Abstract

The problems and opportunities of transition to sustainable energy systems constitute one of the primary challenges in governance for sustainable development in general and for decarbonisation and climate policy in particular. Drawing on the work of Elinor and Vincent Ostrom and their collaborators on common-pool resource management and polycentric governance, researchers in the field have been calling recently for systematic attention to be paid to polycentric governance of energy systems (see for example Goldthau, 2014). This paper makes a contribution to this research agenda by **examining the extent to which the UK's electricity infrastructure and associated governance system can be characterised as polycentric, and the ways in which it exhibits common problems of polycentric governance**.

This study finds that the UK electricity system exhibits some, but not all, of the characteristics proposed by McGinnis (2016), building on V. Ostrom's (1972) framework, and could therefore be seen as proto-polycentric. There are multiple centres of decision making, but some are more powerful than others. There are overlapping jurisdictions in some cases, such as the supply market, and non-overlapping ones in others, such as the monopoly distribution networks. There is some mutual adjustment, but in many cases actors are bound by rules set by higher authorities, rather than more independent and equal relationships. Institutional relationships are in some ways dynamic, but the creation of new institutional arrangements is constrained by the rules. The outcomes of emergent order and scale economies are limited.

The persistent problems of polycentric governance described by McGinnis (2016) are present to various degrees in the UK electricity system, and prove to be a useful heuristic for critiquing its governance and identifying potential remedies to problems. These include:

- structural inequities of access to energy,
- incremental bias and high complexity in the energy industry codes as shown by Lockwood et al (2015),
- structural fissures between climate and energy policy exacerbated by the dismantling of the Department of Energy and Climate Change,
- lack of geographical coordination in the roll-out of smart meters, and
- lack of normative clarity in the way that the objectives of the 'energy trilemma' of sustainability, affordability and security are interpreted by different people.

The paper concludes by suggesting policy approaches that could be fruitful in dealing with the problems identified, including reducing barriers to entry for local and community energy suppliers, greater diversity of scale with local energy markets, and increased accountability and democracy through public ownership of monopoly infrastructure.

Paper

Introduction

A number of scholars, including Sovacool (2011, 2013), Goldthau (Goldthau, 2014) and Bazilian (Bazilian, Nakhooda, & Van de Graaf, 2014) are pursuing a research agenda of polycentric approaches to energy systems. This paper contributes to that research agenda. It draws on the Ostromian theoretical tradition of institutional analysis of polycentric governance systems (Aligica & Tarko, 2012; McGinnis, 2016; V. Ostrom, 1972; Polski & Ostrom, 1999), to consider the UK energy system, and finds that the polycentric paradigm is a powerful tool for understanding the strengths and weaknesses of UK energy governance.

Polycentric governance is defined by V. Ostrom as:

> "A pattern of organisation where many independent elements are capable of mutual adjustment for ordering their relationships with one another within a general system of rules" (V. Ostrom, 1972, p. 21)

McGinnis, defines structural (1), process (2) and outcome (3) characteristics of polycentric governance as follows:

> "A polycentric system of governance consists of (1) multiple centers of decision-making authority with overlapping jurisdictions (2) which interact through a process of mutual adjustment during which they frequently establish new formal collaborations or informal commitments, and (3) their interactions generate a regularized pattern of overarching social order which captures efficiencies of scale at all levels of aggregation, including providing a secure foundation for democratic self-governance." (McGinnis, 2016, p. 5)

He also identifies six "persistent problems" of polycentric governance as follows:

1. Structural inequities
2. Incremental bias
3. High complexity
4. Deep structural fissures
5. Coordination failures
6. Lack of normative clarity

This paper, building on and developing further insights from Goldthau (2014), argues that using a polycentric paradigm to consider energy systems is useful for those making sense of such systems, whether they are working within them as institutional entrepreneurs or policymakers, or observing them as scholars. This is demonstrated by considering the ways in which the UK energy system exhibits characteristics of polycentric governance, and engaging critically with the strengths and weaknesses of this.

Benefits of polycentric governance

Polycentric governance systems are contrasted with 'monocentric' systems. A pure monocentric system would involve a complete monopoly of power, so any valuing of democracy, decentralisation and participation involves a degree of polycentricity.

Many of the benefits of polycentric governance systems are shared with markets. These include free entry and exit, enabling creativity and innovation, and distributed and direct expression of

preferences, enabling the full complexity of different people's preferences to be visible in a way that would overwhelm a centrally planned economy. However, the polycentric governance paradigm is broader than the market paradigm, and can provide a useful way of retaining the benefits of markets without relying on profit motives or price mechanisms.

The UK energy system

The UK energy system can be broadly defined to include electricity, gas, transport, and heat, from primary energy to consumption. This paper focuses on the electricity and gas systems, with particular focus on the governance of licensed activities. Energy UK lists 11 different types of energy industry license. Each of these requires compliance with a number of 'codes', or sets of detailed rules, which are shown in Figure 1.

	Code Administrator	ENA	Electralink	National Grid	National Grid	National Grid	Elexon	Gemserv	Joint Office	Gemserv	Electralink	Gemserv
	Code	D-Code	DCUSA	CUSC	Grid Code	STC	BSC	MRA	UNC	SEC	SPAA	GDAA
Type of licence issued	Electricity Transmission Owner					★	★					
	Distribution Network Operator	★	★	★	★		★	★				
	Electricity Interconnector	★		★	★		★					
	Electricity generation	★	★	★	★		★					
	Electricity supply	★	★	★			★	★				★
	Gas interconnector								★			
	Gas shipper								★			
	Gas supplier							★	★		★	
	Gas transmission								★			
	Gas distribution								★		★	
	Both Gas and electricity smart metering communication licence[1]									★		

[1] Data Communication Company

Figure 1 (Energy UK, 2016)

Each code is governed by a panel. This panel reviews requested modifications to the code, and sends these to Ofgem, the regulator, for approval. Modifications may usually be proposed by any party to the code (Lockwood, Mitchell, Hoggett, & Kuzemko, 2016). Lockwood et al (2016) criticise the codes system for being complex and fragmented, dominated by incumbents, and not keeping pace with changes in energy policy. This fits with some of the problems of polycentric governance identified by McGinnis (2016), and suggests that polycentric analysis of the UK energy industry codes can be valuable.

The discussion of the UK energy industry codes draws on summary documents published by industry (Elexon, 2014; National Grid Electricity Transmission, 2015a, 2015b, 2015c; National Grid Electricity Transmission plc, 2013), code documents themselves (Elexon Ltd., 2008; National Grid Electricity Transmission plc, 2013), and on (Lockwood, Mitchell, Hoggett, & Kuzemko, 2015; Lockwood et al., 2016). These documents are not referenced individually in the text, but listed in the bibliography.

The characteristics of polycentric governance in UK energy governance

This section draws on McGinnis' (2016) description of the key characteristics of polycentric governance to test its explanatory power with reference to the UK's energy system. The question asked in this section is 'to what extent is the UK energy system currently polycentric?'

Multiple centres of decision making

The first characteristic, which McGinnis classifies as structural, is that of having multiple centres of decision making, which he also calls 'centres of authority' or 'decision units'. Each interacts with others, and is partially autonomous.

> "There exist multiple centers of decision-making authority (or decision units), each sufficiently autonomous to be able to make collective decisions for explicitly organized or latent groups whose members share at least some common interests" (McGinnis, 2016, p. 5)

There are multiple centres of decision-making in the UK energy system, some of which exhibit a variety of different characteristics described by McGinnis. For example: energy supply companies; consumers; the energy system regulator Ofgem; community energy groups; renewable energy trade bodies; Distribution Network Operators (DNOs); the National Grid; and generators. Some make decisions on behalf of others, such as the energy market regulator Ofgem which sets the rules under which others must operate. Others make decisions autonomously about their own actions, but are responsive to the decisions of others. For example, energy supply companies compete in the retail market and set prices autonomously, but with awareness of prices set by competitors.

For McGinnis, the multiple centres of decision-making are conceived of as decision units made up of groups of individuals. These groups, rather than the individuals of which they are formed, constitute the main unit of analysis, although it is considered that agency ultimately lies with individuals. This is true to the Ostroms' mixed approach to methodological individualism.

Individuals may be part of several different decision units, where they have "partially shared interests" (McGinnis, 2016, p. 6) with others within the group, but may disagree on other matters. In the UK energy system, the same individual may be a consumer, an employee of an energy charity and a volunteer in a community energy group, or part of a government department on secondment and a longer term employee of a large energy company, thus participating in several different decision units.

A system may also have latent groups which could become active, and which need to be considered in analysis. McGinnis argues that "no polycentric system of governance can be fully understood without acknowledging potential groups that remain latent" (McGinnis, 2016, p. 6). Although consumers are individual decision-makers in the energy market, they are not a decision unit, but could become one if they were to organise into a group. On the other hand, they are taken into account as a group by the regulator, which has a duty to protect their interests, and by energy supply companies who compete for their custom.

Overlapping jurisdictions

The second characteristic of a polycentric governance system is that the decision units

> "have overlapping jurisdictions (or areas of responsibility)." (McGinnis, 2016, p. 5)

In the UK energy system, the extent to which decision units have overlapping areas of responsibility is mixed. Energy supply companies may supply customers in any part of the country, and compete for their custom. They therefore do have overlapping jurisdictions in terms of territory. Distribution

Network Operators, however, each have responsibility for one region, and do not overlap with each other in terms of territory. However, for McGinnis, the overlapping jurisdictions are defined more broadly than simply by territorial boundaries, and can be defined "in functional or other terms" (McGinnis, 2016, p. 7). He considers that "two jurisdictions overlap when they share some of the same people, resources, or institutions in common" (McGinnis, 2016, p. 7). Distribution Network Operators and the National Grid are both concerned with regulating the frequency and voltage of the electricity system[1], and both generators and consumers also affect these power quality factors, which are a shared resource. The rules of the energy system, or energy industry codes, are developed by the parties to the code, which include representatives of each of these groups, thus several decision units have institutions in common.

At the local level within the UK, many types of organisation are concerned with the development of renewable energy and energy efficiency, including the local government, private sector, charity sector and community organisations.

These two first characteristics, of multiple centres of decision-making and overlapping jurisdiction, are 'structural' factors. If both are present in a governance system, McGinnis would class this system as fragmented, but not necessarily polycentric.

Mutual adjustment

The next two characteristics of polycentric governance are questions of 'process'. For the first of these, the decision units

> "interact with each other through a process of mutual adjustment (which is limited in the sense that it rarely requires the complete submission or conversion of all parties to a uniform standard of behavior)" (McGinnis, 2016, p. 5)

These processes of mutual adjustment take place through behaviours of "competition, negotiation, contracts, joint production, coordination and dispute resolution" (McGinnis, 2016, p. 9, citing Ostrom, Tiebout and Warren 1961). It is a 'partisan mutual adjustment' process where groups respond to each other whilst protecting their own interests (McGinnis, 2016 citing Lindblom, 1965). In the UK energy system, mutual adjustment takes place at many spatial and temporal scales. For example, the electricity wholesale market makes use of both competitive market mechanisms and negotiated rules. The industry codes clearly define what each decision unit must do to maintain the shared resource of regulated voltage and frequency. The grid code, for example, specifies the rules by which generators increase or decrease their generation during a half-hour 'settlement' period, in response to requests from National Grid, including a competitive bidding process and price mechanism (National Grid Electricity Transmission plc, 2013). On a longer temporal scale, the regulator Ofgem consults with industry when developing new regulation, and adjusts to information received through this process, and industry complies with regulation from Ofgem. This is not a fully mutual adjustment, as Ofgem can enforce compliance whilst it does not have to act on consultation responses. Arguably, this may involve 'conversion of all parties to a uniform standard of behaviour', and therefore may not comply with MgGinnis' definition of a polycentric system.

[1] If the Distribution Network Operators (DNOs) are converted to Distribution System Operators (DSOs) as is proposed, this would lead to even greater overlap in the jurisdiction of frequency and voltage with the National Grid (BEIS & Ofgem, 2016)

The focus on the process of everyday mutual adjustment as a core political process is very different to the large-scale electoral politics that are the focus of much political discourse. For McGinnis, governance is embodied in our day to day existence:

> "Much of our political discourse (and academic work in political science) obsesses on elections and lobbying and campaign contributions, but most real policy outcomes emerge from other processes, undertaken by other kinds of actors, especially by citizens themselves. In short, government is not some kind of *disembodied* force imposed on us from above; instead it IS us, since processes of governance are constructed out of the tools that we and others have devised to help us address practical policy problems and to realize our shared aspirations." (McGinnis, 2016, p. 8 italics added)

This perhaps echoes some of the feminist emphasis on the politics of the everyday, the idea that 'the personal is political' (ref). It also has a strong resonance with the Ostroms' emphasis on the development of institutions as a craft, requiring skills and responsiveness to the organisational context analogous to the embodied practice of working in relationship with a material, rather than with abstractions. However, it is perhaps an idealised view, which does not interrogate who the 'us' are whose actions effect policy outcomes. Inequalities, unearned privilege, and intersectional oppressions also need to be considered in the context of the tools we use to solve policy problems.

Mutual adjustment is, at its core, about relationships. It is an ideal of relationship between equals, where both parties adjust to each other. In the context of organisational theory, Ladkin (2010) and Laloux (2016) attempt to understand processes of mutual adjustment in a grounded way. Ladkin theorises leadership as taking place in moments of relationship between people, and moving from one person to another as their skills and experience and the context require. Laloux describes an "advice process" of decision making in "re-imagined" organisations, whereby individuals in a team are empowered to make decisions autonomously, but expected to listen to others first. Relationships between organisations are not necessarily the same thing as relationships between people, but take place primarily through interpersonal relationships of their members, as well as through more formal contracts and rules of interaction.

In practice, achieving equality in a relationship is not easy, particularly in contexts where hierarchy is the norm. The principle of subsidiarity ensures that in a case of ambiguity, the smaller decision-unit takes precedence. Given existing inequalities, this may be a more effective way of recognising and compensating for the advantages of larger or more powerful parties than pure mutual adjustment.

Dynamic institutional relationships

In a polycentric process, during mutual adjustments, centres of decision making

> "frequently establish new formal collaborations or informal commitments (in order to address common problems and/or realize shared aspirations)." (McGinnis, 2016, p. 5)

In the UK energy system, community and independent actors do develop collaborations, but the scope of their actions is limited by the regulation and the energy industry rules. The parties to the codes collaborate with each other in code modification processes overseen by code panels. At the same time, their collaboration in the market is limited by regulation which enforces competition. New entrants to the market, and community energy groups and local authority energy initiatives which fall outside of the formal codes governance process, also create shifts in relationships in the energy system. However, these have limited power to change the codes themselves.

McGinnis discusses dynamic institutional relationships under the heading of 'institutional diversity'. Ostrom et al. (1999) see institutional diversity as valuable, because developing effective rules for use of a resource is always a process of trial and error, and diversity in a linked system means that several different institutional experiments are running at the same time and learn from each other. A polycentric system both creates and needs diversity of institutions, cultures and values. Dealing with this diversity involves skilful agonistic governance, which relies on some shared values but also embraces heterogeneity. In practice the insights of Audre Lorde are pertinent here "It is not our differences that divide us. It is our inability to recognize, accept, and celebrate those differences."[2]

Emergent order

The final two characteristics of polycentric energy systems relate to their outcomes.

> "Their interactions generate a regularized pattern of social order (which either emerges spontaneously or involves some level of coordination);
>
> > a. This social order reinforces the continued operation of the overarching system of law (or more broadly a shared repertoire of institutions, including laws, rules, norms, and shared understandings),
> >
> > b. And yet this social order nonetheless supports relatively separable subsystems within which diverse groups live under different cultural understandings and norms," (McGinnis, 2016, p. 5)

The UK electricity system is highly ordered. It operates under a system of rules, which are written down in the energy system codes and other regulations, and these direct the activities of all of the actors in the system, from the National Grid to the consumers. One could identify a number of 'relatively separable subsystems'. The gas system and the electricity system share few codes (only the metering code). The infrastructures are physically separate, and interact mainly where gas is burned to produce electricity. Within the each of the gas and the electricity systems, the different license types share multiple codes, as one role of the codes is to regulate the interactions between the different roles within the electricity or the gas systems. There are not obviously 'different cultural understandings and norms' through the system, however, as shared regulatory principles of competition, non-discrimination and cost reflectivity (Lockwood et al., 2015) operate throughout the codes and regulation. The rules are generally uniform throughout the country. On this measure, therefore, the UK electricity system is only partially polycentric.

However, the community energy sector and the local authority energy system are beginning to form an emergent polycentric system of local energy transition. These share values of "regional economic development, fuel poverty reduction, energy system decarbonisation and self-governance/self-determination" (Hall, Foxon, & Bolton, 2015, p. 11).

Scale economies

In addition to a system of rules and pattern of social order, a polycentric system

[2] This is a quote widely attributed to Audre Lorde. In her 1980 Age, Race, Class and Sex: Women Redefining Difference, Lorde wrote: "Certainly there are very real differences between us of race, age, and sex. But it is not those differences between us that are separating us. It is rather our refusal to recognize those differences, and to examine the distortions which result from our misnaming them and their effects upon human behavior and expectation". It is therefore fair to attribute the widely quoted phrase as the insights of Audre Lorde, even if the precise words may or may not be hers.

> "supports outcomes that capture efficiencies of scale at all levels of aggregation, including sustaining capacities for self-governance (which includes protection of individual liberty, significant autonomy for minority groups, and effective forms of cooperation at the level of the broader society)" (McGinnis, 2016, p. 5)

Part of the argument here is that different goods and services are best provided at different scales. Scale economies does not necessarily mean that bigger is better or more efficient, but that it is a question of finding the right scale for the particular activity taking place. Different UK sustainable energy system outcomes are best addressed at different scales. Insulating of buildings to make them more energy efficient, for example, requires detailed attention to the idiosyncrasies of each building and the requirements of its occupants, and is not likely to be more efficient at a larger scale. Manufacturing insulation materials, and developing supply chains for these materials, on the other hand, is more efficient at a larger scale. In practice, initiatives such as the Green Deal have favoured large scale insulation approaches, rather than making full use of smaller scales where appropriate.

In the electricity sector, national and international interconnection allows reliability of electricity supply to be achieved with much lower generation and storage costs than would be needed for local isolated electricity systems. This is because it makes use of diversity of time of demand, and diversity of time of generation in different geographical locations, as well as economies of scale associated with some forms of generation. However, there are also opportunities for cultural shifts in demand patterns, local generation, and local balancing that are not being realised. Local energy markets (Cornwall Energy, 2015) do not currently exist, and are not possible under current regulation. Additionally, some scale economies are primarily associated with concentration of activity rather than pure size. For example, electric cars work well in a locality which has a high density of charging points.

On the other hand, "there is no reason to preclude the possibility that individuals or communities living within polycentric order might trade off economic efficiency for other goals, such as clarity, accountability, fairness, or physical sustainability" (McGinnis, 2016, p. 13). Transaction costs of a local, democratically accountable energy organisation that supports widespread participation may be greater than the current centralised one, but the value of participation may make it worth the compromise in economic efficiency. In addition, democratic skills need to be learned (Dobson, 2014; Toqueville, 1838), and local decision-making may be a good way to enable this. The neoliberal economic and political paradigm does not allow citizens to make this kind of trade-off, but rather assumes that economic efficiency is always the primary or only goal.

Summary

This section has assessed the extent to which the UK energy or electricity system fits with each of McGinnis' characteristics of polycentric governance. Overall, there is no characteristic where the UK electricity system perfectly fits. However, there is a reasonable amount of fit with the structure characteristics, a moderate fit with the process characteristics, and limited fit with the outcome characteristics. This is shown in Table 1, with a colour gradient where bright green (which does not apply to any) would be perfect fit, and red (which also does not apply) would be no fit at all.

Table 1: fit of the UK electricity system with McGinnis' characteristics of polycentric governance

McGinnis' characteristics of polycentric governance		UK electricity system fit
Structure	Multiple centres of decision-making	Yes, but some are more powerful than others
	Overlapping jurisdiction	Yes, in some cases
Process	Mutual adjustment	Yes, but some actors more powerful than others so not fully mutual

	Dynamic institutional relationships	Yes, within the codes system, but slow-changing
Outcome	Emergent order	Order, but not very diverse or emergent
	Scale economies	Very restricted ability for local electricity development

There are many ways to interpret this analysis. If the UK energy system is structured as polycentric, but is not achieving the outcomes of emergent order and scale economies, does this mean it is suffering the 'worst of both worlds'? Does this mean that there is room for improvement towards the polycentric ideal? Or that the polycentric features should be removed and replaced with a simple hierarchical structure? Does this mean that the polycentric lens is an appropriate one for exploring the UK energy system?

Ultimately, perhaps a core test for a polycentric political system is that

> *"No one office or decision structure has an ultimate monopoly over the legitimate use of force in a polycentric political system"* (McGinnis, 2016, p. 8, citing Vincent Ostrom (Ostrom [1972] in McGinnis 1999: 54, 55; italics in original)).

In principle, one could say that the UK parliament has got 'an ultimate monopoly over the legitimate use of force' in the UK energy system, as it can pass bills and acts which the wider system of rules and practices of the energy industry must ultimately comply with. In theory, parliament itself is accountable to the electorate. In practice, energy industry incumbents have important lobbying power, particularly through working with civil servants on energy policy development.

Persistent problems of polycentric governance in UK energy governance

This section will take a normative perspective. It considers the perceived benefits of polycentric governance, as well as the 'persistent problems' and potential remedies identified by McGinnis, again in relation to the UK energy system.

Structural inequities

Some groups find it easier to organise themselves and act effectively within a polycentric system than others. In particular it is more difficult for large, heterogeneous and geographically dispersed groups to organise effectively (McGinnis, 2016, p. 16, citing Olson 1965). This may mean that smaller, more homogeneous groups dominate the dynamics of the system as a whole, as they are easily able to coordinate with each other and promote their own interests. One way that this inequity can be addressed is to reduce the 'transaction cost' of organising and coordinating actions (McGinnis, 2016, p. 16). Social media and other digital communications can play a role in this.

The community energy sector in the UK, and the rhetoric of 'big society' employed by the 2010-2015 UK government, both provide some opportunity for greater participation and a more polycentric system. However, setting up effective community energy groups is much easier for communities with financial resources, social capital, business and technical experience and knowledge, and time to spend on voluntary work (Catney et al., 2013; Johnson & Hall, 2014). Community energy support services, funding and low interest loans can help to address this. Similarly, the big six energy companies are much more able to participate in modifying the energy industry codes than smaller suppliers (Lockwood et al., 2015).

Supporting those groups or individuals who have higher 'transaction costs' of organising is one useful way of addressing structural inequalities, although this does not remove the need to address

underlying social inequalities themselves. A more equal society has much greater potential for equal democratic participation.

Lack of normative clarity

McGinnis' description of the problem of 'lack of normative clarity' is of situations where different groups or individuals have conflicts of interest, or act to the benefit of their own interests rather than for the benefit of society as a whole. The groups whose interests dominate are likely to be those who have advantages in organising collectively, as described under the heading 'structural iniquities'. Mechanisms to protect the interests of those with less collective power in the polycentric system are needed to balance this (McGinnis, 2016, pp. 21–22).

Clarity over the macro objectives of society is a complex matter, where self-interest may be hidden behind a rhetoric of universal values. Measures of progress which take no account of distributional impacts, such as GDP, profit, or simplistic economic efficiency, are presented as being for the overall good of society, whereas they can mask dynamics of growing material inequality. Alternative measures of progress, such as wellbeing or happiness attempt to unsettle this hegemony, and measures that explicitly include measures of inequality (Cobham, 2013; New Economics Foundation, 2014) make the distributional dynamics visible.

In relation to the UK energy system, the elements of the 'trilemma' (DECC, 2014), of environmental sustainability, affordability, and reliability/security are in tension with each other, and there is also lack of normative clarity about what each of them means. Distinguishing between normative debates that are about the interests of different individuals or groups, and normative debates that are about individual preferences, is not easy, and this uncertainty is used by all sides in political debate.

Incremental bias

McGinnis sees polycentric systems as changing incrementally, rather than being able to easily make big changes. Polycentric systems are therefore sometimes criticised for being conservative, although they are continually changing in small ways. This incrementalism is partly because of the large number of actors who have veto power, and can lead to barriers to entry for new entrants, and entrenched power of the incumbents, as well as an inability to make substantial changes when needed (McGinnis, 2016, pp. 16–17).

This description fits very closely with the criticism of the UK energy industry codes made by Lockwood et al (2015), without any reference to the term 'polycentric governance'. They argue that the current system is unable to innovate sufficiently for a sustainable energy transition, partly due to historic restrictions on the ability of the regulator, Ofgem, in directly proposing modifications to the code and taking control of strategic changes[3]. At the same time, the codes are changing incrementally all the time: "For example, there have been 241 proposed modifications to the CUSC since 2001, and 327 to the BSC since 2010. The UNC has been updated 275 times since 2005." (Lockwood et al., 2015, p. 20).

McGinnis suggests that to avoid incremental bias, a polycentric system needs to ensure that entry, exit and switching are easy, and that incumbent power is limited. The 2016 Competition and Markets Authority review of the UK energy industry aims to ensure free entry and exit to the market

[3] This is subject to reforms as part of the 2016 Competition and Markets Authority review, discussed in Lockwood et al. (2016).

(Competition and Markets Authority, 2016), which can reduce incumbent power, although Lockwood et al. (2016) argue that their remit was too limited.

High complexity

Polycentric governance systems tend to become increasingly complex, as people add new rules and ways of making changes. Although participation is supported by the openness to people adding their own ideas to the "institutional repertoire", if it gets too complex, they could get "immobilized by confusion", leading to a barrier to participation (McGinnis, 2016, p. 18).

This is seen in the rules of the UK energy system, where the energy industry codes run to a total of 10,000 pages (Lockwood et al., 2015, p. 18), and the complexity creates a severe barrier to participation:

> "It also appears to be the case that many even in the large incumbent actors struggle with the complexity and burden of codes, and there is a view that the process is in practice dominated by a few highly skilled individuals who have developed in-depth knowledge of codes and governance processes over many years, surpassing that even of code administrators, let alone that of the regulator or government." (Lockwood et al., 2015, p. 32)

McGinnis' description of the tendency for polycentric systems to ever-increasing complexity suggests that this complexity may not be strictly necessary for the effective functioning of the energy industry under a market, but may be the result of historical processes of adding to the 'institutional repertoire'. At the same time, this complexity may be seen as functional and useful to the incumbents, who have an oligopoly of skills in negotiating the complex system.

Deep structural fissures

The ideal of a polycentric system is holistic. There is polycentricity in each subsystem, and these subsystems are connected and interact with each other. McGinnis considers polycentric governance as an overall regime of governance in a spatial jurisdiction. He identifies several different 'subsystems' within a polycentric system of overall governance, including economic, political, legal, scientific-technological, social and cultural. Energy could be seen as one such subsystem. He also identifies different dimensions or forms of interaction, including voluntary exchange (markets) and obedience to authority (bureaucracy). One could also add 'mutual agreement' or 'deliberative discussion' to this list. The fact of being limited to "a single dimension of permissible interactions", i.e exclusively acting through obedience to authority, or exclusively acting through voluntary exchange, limits the polycentricity of the system.

Another type of deep structural fissure exists when one part of the system is isolated from another, or becomes captured by one authority such as a hierarchical sovereign or a monopoly. Connections between different subsystems can mitigate the risk of complete monocentric capture of any other part of the system and achieving total hegemony. In practice, total hegemony of a monocentric system is as unattainable a governance pattern as is a fully polycentric system (McGinnis, 2016, pp. 18–20).

In the context of sustainable energy, there are fissures between the subsystems of climate discourse and the energy discourse, the interests of incumbent fossil fuel companies and the wider global interests in relation to climate change, the interests of fossil fuel companies and local environment, the health impacts of fuel poverty and investment in healthy housing, the health impacts of poor air quality and the car industry and transport policy. For example, the energy industry codes aim to be 'cost reflective', but the cost of climate change or air quality is not included in the calculation.

Similarly, there are fissures between the modes of interaction of market principles of 'cost reflexivity', and a needs-based approach to ensuring universal access to basic energy services.

However, as McGinnis says, where there are deep structural fissures, there is an opportunity to make connections. Connections, for example between energy and climate, and between energy and health dimensions are being made by many people, leading to positive outcomes.

Coordination failures

Inadequate coordination is one of the most frequent criticisms made of polycentric systems, as discussed at the start of this section. Pahl-Wostl and Knieper (2014) consider coordination to be part of the definition of polycentricity, categorising uncoordinated decentralised power as 'fragmented' rather than polycentric. McGinnis sees co-ordination itself as a collective good which needs to be provided through acts of leadership and public entrepreneurship. This is part of his argument that the order of a polycentric system is not 'spontaneous', as it requires active work.

In a local energy system, there are many opportunities for coordination, for example, the 'boilers on prescription'(Burns & Coxon, 2016) study in Sunderland coordinated energy saving with health outcomes, where doctors are able to prescribe an energy efficient boiler to low-income households with pulmonary diseases, improving health and wellbeing and reducing healthcare costs, as well as improving energy efficiency of heating and reducing fuel bills. Achieving this involved understanding the metrics used by clinical commissioning groups in order to measure benefits. Similarly, the Centre for Sustainable Energy (Centre for Sustainable Energy, 2014) coordinate with healthcare professionals to identify households in fuel poverty with children who have respiratory illnesses such as asthma. They provide specialised energy advice to these households. This type of coordination can be very effective, but it is only possible if the work of coordinating is recognised and resourced.

The plan to roll out smart meters in the UK through suppliers, rather than via geographically specific networks in local areas, misses an opportunity for local coordination with community groups and service providers who could support consumers to make best use of the new meters to manage their energy consumption (Centre for Sustainable Energy, 2015).

Summary

Overall, McGinnis states that polycentric approaches to governance have some advantages and some disadvantages. On the downside, polycentric systems can have higher transaction costs, and less accountability, as it is less easy to see who is responsible for a decision. On the other hand, they can lead to greater satisfaction with the final outcomes, and enable people to contribute to public goods and services. They can also achieve scale economies by allowing different activities to be carried out at different scales.

The discussion of the persistent problems of polycentric governance in the UK energy system above takes a pragmatic approach of understanding the weaknesses of a polycentric system and considering ways to mitigate their impact, rather than taking a black and white comparative approach to evaluating polycentric governance. This can help us to see beyond simplistic market vs state debates. Many of these weaknesses are visible in the UK energy system, with the incremental bias and high complexity particularly well-documented in the energy industry codes by Lockwood et al. (2015). McGinnis' discussion of potential remedies to these perennial problems provides a framework for exploring solutions that retain the benefits of a polycentric system, as alternatives to solutions which make the system more monocentric.

Table 2: Persistent problems of polycentric governance in the UK electricity system

Persistent problems of polycentric governance	UK electricity system
Structural inequities	Fuel poverty, incumbent power, barriers to market entry
Incremental bias	Yes – well documented by Lockwood et al in relation to energy industry codes
High complexity	10,000 pages of industry codes
Deep structural fissures	Climate and energy separate – even more now that DECC is closed. Fissures between needs based and cost reflexive approach, and between energy and other domains e.g. health, transport…
Coordination failures	Poor coordination across domains e.g. with healthcare. Poor coordination e.g. in roll out of smart meters by suppliers, poor coordination at local level
Lack of normative clarity	Conflict between universal access, reducing demand, for profit provision, competition, coordination, incumbent desire to retain power, technical efficiency, national economic competitiveness

Conclusion

Lockwood et al (2016) propose to "move away from self-authored regulation in a strategic way", "relocating code governance, including the proposing and development of modifications, out of the hands of industry and into a body within the public sphere". This could resolve many of the problems of polycentric governance identified above. However, depending on how it is implemented and fits in a wider system, it could also be seen as a move away from a polycentric system. This has parallels with the move towards centralisation in public administration which inspired the Ostroms' original research into polycentric governance in the 1970s.

An alternative approach to centralisation could be to find polycentric remedies to the problems highlighted above. Whilst there are moves towards centralisation, there are also moves towards greater diversity of scales, through the development of local energy markets in pilot projects (ref studies in Cornwall), the creation of local authority owned energy supply companies in Nottingham and Bristol, and the proposals for DNOs to become DSOs, taking on a greater balancing role at a regional level. The principles of polycentric governance would suggest that allowing diversity of institutional development at a local level could lead to greater and more rapid innovation. This would require coordination between sectors and scales to be valued and resourced in some way.

Lack of normative clarity could be addressed at each local level, allowing different priorities to emerge in different places. However, it may be that focusing on direct goals of access to energy, low carbon, and wellbeing may be more effective than rigidly sticking to indirect goals enshrined in EU

energy directives, of competition, cost reflexivity and non-discrimination between commercial providers. The UK's departure from the EU may provide an opportunity to do this.

Allowing local energy systems to develop in their own way would be a different approach to institutional innovation – rather than centralising to enable more rapid change in line with policy, new entrants would be allowed, not just to the market, but to regulatory and rule design itself. This may remedy the incremental bias. The ability to begin fresh systems, alongside existing systems, may allow low-complexity institutional systems to be compared with high-complexity systems, and reveal the level of complex rules that is actually required for the system to function. This could remedy the problem of excessive complexity.

Seen in this light, the polycentric paradigm reveals some exciting possibilities for energy system development. It will be interesting to see how those who already support this vision take things forward.

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