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Toward just energy transitions in authoritarian regimes: indirect participation and adaptive governance

Abstract: Low-carbon energy transition is a response to the dual challenges of climate change and sustainable development. Recent years have seen the emergence of the discourse of just energy transitions, which position social justice at the centre of energy transitions. Authoritarian regimes, because of the established tradition of command-and-control policy making, are considered as the main battlefield for advancing a just transition globally. A case review of low-carbon energy transitions worldwide reveals an important and significant knowledge gap on justice issues in more authoritarian regimes. Two in-depth case studies in China show that, although social injustice seems to be inevitable for energy transitions in authoritarian regimes, adaptive transition governance mainly through indirect participation mechanisms offers a pathway toward juster energy transitions. The study calls for more nuanced and longer-term perspectives of social injustice that emerge in the process of energy transitions in authoritarian regimes.

***Keywords*:** Energy transition; Social justice; Authoritarian regime; Adaptive governance; China

1. Introduction

Energy transitions refer to profound changes taking place in the energy systems, a slow process which can last decades or even centuries (Grubler, 2004, 2012). Referring back to the history of energy transitions, following the wake of the first Industrial Revolution, the initial major transition was from wood to fossil fuels (Solomon and Krishna, 2011). After the global oil crisis in the 1970s, energy transition strategies that seek for alternative energy solutions have emerged in many countries in the world. Meanwhile, climate change has become a high-profile issue for both the North and the South in the past few decades. In the *UN Paris Climate Change Conference*, the milestone *Paris Agreement* for the first time requires virtually every country in the world to set out its plans to reduce greenhouse gas emissions. To achieve this goal, it necessitates fundamental transformations of current energy systems.

Facing a new wave of energy transitions, the once dominated technology-centered perspective is gradually abandoned, and the energy system is increasingly viewed from the lens of socio-technical theories (Geels, 2002 & 2007; Kern and Smith, 2008). Notably, the emergence of the "just energy transition" discourse marks increasing recognition of the importance of social justice in energy transitions. As noted by Sakellariou (2013), "reducing carbon emissions will not necessarily make renewable technologies socially just" (p. 245). If justice issues of the ongoing process of energy transitions are not accounted for carefully, profound transformations in global energy systems might create new, or reinforce old, inequalities and injustices (Miller et al., 2013; Jenkins et al., 2017). Therefore, it is crucial that justice norms to be integrated into transition governance and that just energy transitions to be cognitively recognized, theoretically conceptualized and practically implemented.

In transition governance, multi-level governments deploy a variety of governing approaches, ranging from command-and-control regulations to the provision of services and resources (Bulkeley and Kern, 2006). Seen from a politico-institutional perspective, the style of transition governance is deeply shaped by a country's incumbent political systems, institutional infrastructures, and power relations. Scholars argue that authoritarian regimes tend to follow a hierarchical governing tradition in energy transitions (Mol and Carter, 2006; Carroll and SL Jarvis, 2013; Lo, 2015) and thus hold greater possibilities of

enforcing an unjust energy transition. Authoritarian countries are therefore considered the frontier for advancing a just energy transition globally. Nevertheless, very little knowledge has been gained on the causes, patterns and implications of social injustice during current wave of low-carbon energy transitions in authoritarian regimes. This critical knowledge gap is verified through a retrospective case review of existing empirical studies on low-carbon energy transitions worldwide. Of the 44 cases of social injustice documented in the literature, only six cases were reported in more authoritarian regimes. In an attempt to address this knowledge gap, the study further presents two in-depth cases of energy transitions in China and the induced justice issues. Despite the inescapability of social injustice of authoritarianism, the two cases exhibit considerable adaptive characteristics of authoritarian governance in China, mainly through effective indirect public participation. We argue that this responsiveness and adaptability in transition governance offers a pathway toward juster energy transitions in authoritarian regimes.

The remainder of this article is structured as follows. Section 2 reviews extant literature on low-carbon transitions, authoritarian governance and social justice. A case review is presented in section 3, sketching the landscape of social injustices in energy transitions during the past decade. The case review uncovers a critical knowledge gap that very little is known about justice issues during energy transitions in more authoritarian political regimes. Section 4 presents two representative cases of energy transitions in a typical authoritarian country, China, and provides discussions on whether and to what extent authoritarian transition governance is doomed to breed social injustice. Conclusions are drawn in section 5.

2. Literature review

2.1 The emerging discourse of a 'just' energy transition

Transition research aims at understanding the process of socio-technical transitions (Holtz et al., 2008). Socio-technical transitions refer to "deep structural changes in systems, such as energy, that involve long-term and complex reconfigurations of landscapes with technology, policy, infrastructure, scientific knowledge, and social and cultural practices towards sustainable ends" (Newell and Mulvaney, 2013: p. 133). The energy sector is the primary contributor to carbon emissions (Heffron and McCauley, 2018). Low-carbon energy transition involves the reconfiguration of the energy production, transmission and consumption system with the ultimate goal of less carbon dioxide emissions (Andrews-Speed, 2016). Scholars try to understand this process through the lens of socio-technical theory, which perspective is reflected from widely used analytical frameworks such as the multilevel perspective (MLP) (Geels, 2002) and the technological innovation systems (TIS) (Hekkert et al., 2007).

In recent years, new research avenues surface in transition studies. Scholars call for a "spatial turn" that pays more attention on the role of space in energy transitions (Raven, et al., 2012; Rutherford and Coutard, 2014; Huang and Castán Broto, 2017). As argued by Bridge et al. (2013): "energy transition is fundamentally a geographical process that involves reconfiguring current spatial patterns of economic and social activity" (p. 331). In addition to the spatial turn is a "demand turn" in transitions research. Conventional approaches to facilitating energy transitions often adopt a supply-side perspective, revolving around technological innovations and the leading role of the so-called 'system builders' (Musiolik et al., 2012). Instead, a demand perspective places the major focus on energy reduction on the demand side, as well as the processes of co-construction of user practices and technology (Axsen and Kurani, 2012; Geels et al., 2018). Energy transitions are also increasingly more political (Meadowcroft, 2009; Truffer and Coenen, 2012). A variety of actors with differing interests get engaged in the multi-scalar and multi-dimensional transition process (Gailing and Moss, 2016; McEwan, 2017; Wodrig, 2018).

Emerging dynamics of energy transitions raise further concerns on the social implications of the transformative process (Bickerstaff et al., 2013). The geographical characteristics of low-carbon energy transitions might give rise to issues such as uneven distribution of energy resources; the demand-side approach of energy transitions would involve the change of lifestyles, the reshaping of social practices, and the alteration of cultural preferences, which renders a necessity of raising awareness in issues such as information transparency and participation; while the politics of low-carbon energy transition directly reflect power relations in the energy systems and the confrontation between the advantaged and the disadvantaged (Bulkeley et al., 2014; Reames, 2016). In response, scholars call for more attention on issues of social justice in energy transitions.

Justice is a continuing human inquiry into itself and the society, dating back to ancient philosophers such as Plato and Aristotle. John Rawls (1971) was among the first attempting to provide a systematic conceptualization of this notion. In his theory of justice, fairness, namely of the fair distribution of goods and advantages, is given particular importance. Although not without critics, Rawls' work has contributed greatly to the development of justice theories ever since. Early theories of justice (see for instance Rawls, 1971; Barry, 1989) place major interests on distributional justice, which concept is rooted in Adams's (1965) equity theory and is concerned with the equitable distribution of goods or resources. Various principles have been proposed for the fair distribution of goods, for instance the basic needs approach and the capabilities approach (Yenneti and Day, 2016). In practice, different principles might be favoured in different contexts to inform just distributions. Scholars point out that beside fair distribution, a just procedure in the decision-making of distribution is also imperative for achieving social justice (Young, 2011). Therein, procedural justice "is concerned with fairness in the procedures of institutions and the implementation processes of projects or policies" (Yenneti and Day, 2015: p. 665). Among various concepts of justices, distributional justice and procedural justice are the two facets that have gained primary attention and are most frequently applied in various research fields (Bulkeley et al., 2013; McCauley and Heffron, 2018), with no exception in energy studies (Gross, 2007; Simcock, 2016; Fuller and McCauley, 2016). Scholars developed the concept of 'energy justice', defined as "a global energy system that fairly disseminates both the benefits and costs of energy services, and one that has representative and impartial energy decision-making" (McCauley et al., 2013; Sovacool and Dworkin, 2015; Sovacool et al., 2017). Apparently, this definition echoes the principles of both distributional justice and procedural justice in conventional social justice theories.

Building upon recent theoretical development of energy justice, scholars take one step further and call for a 'just energy transition' (Healy and Barry, 2017; Heffron and McCauley, 2018; McCauley et al., 2019). A just energy transition positions social justice as a central element to energy transitions and aims to ensure both distributional and procedural justice in transition activities (McCauley and Heffron, 2018). The concept of 'just energy transition' resonates with wider debates about the relationship between social justice and sustainable development and climate change. The theory of 'just sustainabilities', for instance, emphasizes the relationship between a sustainable society and a just one, and highlights the redistributive function of the transformation process to address social justice and equity (Agyeman et al., 2003; Agyeman, 2008; Bickerstaff et al., 2013). The urgency of the call for a just transition lies in the fact that current wave of energy transitions is taking place at a global scale, and profound transformations are very likely to induce new inequalities or reinforce old ones (Bickerstaff et al., 2013). As warned by Newell and Mulvaney (2013: p. 136), the development of low-carbon technologies can produce injustice in "surprising and unpredictable ways". This has no doubt created new challenges for transition governance.

2.2 Transition governance, authoritarianism and social injustice

Transition governance can be understood as a multi-dimensional, multi-level, multi-actor and multi-phase governing process with the purpose of facilitating systemic transformations of socio-technical regimes towards sustainability (Stoker, 1998; Schot and Geels, 2008; Evans, 2012; Turnheim et al., 2015). Multi-level governments deploy different approaches in transition governance. For instance, at the local level, Bulkeley and Kern (2006) observe four modes of low-carbon transition governance, i.e. self-governing (the capacity of local government to govern its own activities), governing by authority (traditional forms of command-and-control regulation), governing by provision (provision of services and resources), and governing through enabling (coordination of the private-public partnership). Similarly, Turnheim et al. (2015) summarize primary mechanisms of transition governance, namely of command-and-control perspective, public-private perspective and adaptive perspective. Command-and-control is a form of hierarchical governance dominated by the government, public-private governance highlights partnerships between the government and the business community, while adaptive governing approach emphasizes activities of experimentation and social learning, and is open to adjustment and re-definition of transition visions and pathways (ibid.).

Command-and-control governance is often criticized for its top-down, hierarchical and non-participatory decision-making mechanism, the lack of legitimacy and reflexivity, and the resultant incapability of implementing the policy effectively (Lenoble, 2005). Lee and Byrne (2019), for instance, argue that large-scale and centralized energy projects initiated through authoritarian decision-making tend to neglect the social impacts and generate energy inequality for particular stakeholders. In comparison, the adaptive perspective, that highlights knowledge co-production, experimentation and the participation of stakeholders (Roberts, 2004), is gaining popularity in recent years, reflected in a number of governance approaches such as reflexive governance (Voss et al., 2006), transition management (Loorbach et al., 2007), and responsive governance (Hyle, 2016). Technically speaking, the government can choose any combinations of governance approaches, whereas in practice, the style of governance is highly contingent on the country's incumbent political systems, institutional infrastructures, and power relations.

As mentioned, authoritarian countries are considered the frontier for advancing just energy transitions. There is a growing body of literature on transition governance in authoritarian regimes, particularly in countries with more radical strategies of energy decarbonization. China, for instance, is often treated as a typical case of authoritarian governance in facilitating low-carbon energy transitions (Gilley, 2012; Lo, 2015). At the national level, the central government establishes centralized evaluation programs for energy conservation and emission reduction and assigns targets to both enterprises and lower-level governments, who would face political and economic punishment if they fail to fulfil the target (Lo, 2015). At the local level, a common practice of local governments is to resort to governing by authority in low-carbon transitions, through instruments such as mandatory regulations (Yu and Huang, forthcoming).

In recent years, scholars have documented on-going transformations in the governance systems in authoritarian regimes through, for instance, the decentralization of policy making and the involvement of non-state actors (Shi and Zhang, 2006). Some scholars feature China as "adaptive authoritarianism" (Habich, 2015; Ling, 2017), a concept first coined by Samuel P. Huntington (1970) to delineate the adaptive capacity of one-party political systems. Others argue that China represents a vertical 'democratic' political system, with comprehensive and dynamic interplay between the bottom and the top, as well as close attention to the social needs of the public (Naisbitt and Naisbitt, 2010; Bell, 2016).

Concomitantly, new modes of public participation have been introduced. He and Warren (2011) conceptualize the practice of 'authoritarian deliberation', as a way of building legitimacy, soliciting information and reaching consensus. Increasing business lobbying activities, a more pluralised and commercialized media, and the rise of new information technologies have all contributed to a diversifying participation landscape (Mertha, 2009; Deng and Kennedy, 2010). Notably, the significance of Weibo in formulating public discourses and enhancing public participation in China is increasingly recognized (Gu, 2014; Rauchfleisch and Schäfer, 2015; Nip and Fu, 2016; Wang and Shi, 2018). In authoritarian regimes, various participatory forums are intentionally utilized by the government as a 'public feedback mechanism' (Evans, 2010: 18), in a way to perfect the policy-making processes and further to achieve regime goals such as enhancing legitimacy and gathering technical information (Kornreich,2016).

Despite gradual reforms, authoritarian countries still largely follow the established tradition of command-and-control governance modalities (Mol and Carter, 2006; Carroll and SL Jarvis, 2013; Lo, 2015). In particular, compared to the central government, the local governments are more tied to the hierarchical institutions in policy implementation (Habich, 2015). Considering that current wave of energy transitions is very likely to generate a variety of social injustices, the dominance of command-and-control approaches in authoritarian regimes has raised the concern that such countries are more likely to embrace an unjust energy transition. In other words, to facilitate a just energy transition globally, authoritarian countries would be the main battlefield. Meanwhile, on-going and gradual reforms in the hierarchical institutions raise questions of to what extent these reforms can make a difference when it comes to social injustice of energy transitions. It is therefore imperative and urgent to gain more knowledge on the causes, patterns and implications of social injustice during current wave of low-carbon energy transitions in authoritarian regimes. Nevertheless, to date, very little is known about this topic. A case review is conducted in next section, presenting emerging cases of social injustice documented in extant literature. The case review verifies this important knowledge gap on justice issues during energy transitions under more authoritarian political regimes. In an attempt to address this knowledge gap, the study further presents two in-depth cases of energy transitions in China and discusses whether and to what extent authoritarian transition governance under authoritarianism is doomed to breed social injustice.

3. The landscape of social injustice in energy transitions: a knowledge gap *in-the-making*

Through a timely case review, this section presents a general landscape of emerging social injustices in current wave of low-carbon energy transitions. We first conduct a desk research to review cases of injustices in energy transitions studies published in academic journals. Through preliminary search in the database of *Scopus*, 390 journal articles with topics related to low-carbon energy transitions[1] were initially extracted. After a first round of review, we selected out 113 highly relevant articles for case review, which have reported justice-related issues[2] in the main body of the article. For the case review, in line with the mainstream research on social justice, we apply the framework of distributional and procedural justice to categorize documented cases of injustice. By distributional injustice we document cases of unequal allocation of transition benefits and ills and the uneven distribution of their associated

[1] Search phrase: ABS ("socio-technical" OR "innovation system*" OR "sustainability transition*" OR "energy transition*") AND ABS ("renewable energy" OR solar OR "wind power" OR biomass OR "hydro power")

[2] Search phrase: ABS ("socio-technical" OR "innovation system*" OR "sustainability transition*" OR "energy transition*") AND ABS ("renewable energy" OR solar OR "wind power" OR biomass OR "hydro power") AND ALL (*justice OR *equality OR poverty OR *distribution OR *recognition OR *participation OR discrimination)

responsibilities; as for procedural injustice we extract cases of exclusive or unrepresentative transition policy-making or partial information disclosure (Walker, 2009; McCauley et al., 2013). In total, 44 cases[3] of injustices are documented, including 25 cases of distributional injustice and 19 cases of procedural injustice. The earliest case was documented by Harry (2007), in which the author analyzed adverse impacts on local residents' health and quality of life from wind energy development in UK. The latest cases were reported by McEwan (2017) of both distributional and procedural injustice during renewable energy transition in South Africa. It can be seen that our pool of injustice cases captures the deepening processes of current wave of low-carbon energy transitions worldwide that is underway in the past decade.

Table 1 presents an overview of the results by different types of injustice in different regions and countries. Europe is the region with most documented events of injustices, followed by Asia and Africa. While South America reported only one case of distributional injustice in Mexico. Seen from countries, seven cases were reported in Germany, followed by India with six cases, and UK, South Africa and Australia with four cases respectively.

Insert here Table 1: An overview of the emerging injustices of energy transitions

An initial observation is that, countries that are more actively engaged in energy transitions with ambitious plans are normally revealed with more cases of social injustice. For instance, Germany is widely recognized for its pioneering role in low-carbon energy transitions with ambitious plans in transforming its energy system from fossil-dominated to renewables-based (Hager, 2015; Stegen and Seel, 2013). Similarly, in 2008, India released its *National Action Plan on Climate Change*, under which the *Jawaharlal Nehru National Solar Mission* was initiated in 2010, with ambitious plans in implementing the use of solar energy (Pandve, 2009; Yenneti and Day, 2015). Nevertheless, this clearly does not hold true for China, another leading country in key arenas of energy transitions such as renewable energy and electric vehicles.

To examine this closer, we classify documented injustices by different political regime types. From the politico-institutional perspective, social justice can be closely related to the nature of the political system. It is generally recognized that more democratic political systems provide more opportunities for social inclusion and equality, and are thus more capable of delivering principles of social justice; while authoritarian systems tend to contribute toward social inequality and injustice (Pearce et al., 1998; Steiner, 2001; Feygina, 2013). Every year, the Economist Intelligence Unit (EIU) publishes Democracy Index and classifies countries into four different types of political regimes, namely of full democracies, flawed democracies, hybrid regimes, and authoritarian regimes. Table 2 presents the results of countries classified based on the Democracy Index 2017 (EIU, 2018). As can be seen, documented cases disproportionately concentrate in countries with a more democratic political regime. Of the 25 cases of distributional injustice, 20 were uncovered in more democracy-oriented countries (fully democracies and flawed democracies); and of the 19 cases of procedural injustice, only one case was found in more authoritarianism-oriented countries (hybrid regimes and authoritarian regimes). One plausible explanation for the absence of authoritarian regimes from the injustice landscape might be that social injustice in democratic regimes is more visible than that in authoritarian ones. On the one hand, owing to a democratic tradition, actors in more democratic countries are more aware of their rights as regard to equality and participation in energy transition projects. On the other hand, scholars also tend to be

[3] If one project exhibited two different types of injustice, it is counted as two cases of injustices.

more critical on low-carbon transitions in democratic countries, with social justice principles put under harsher scrutiny.

A knowledge gap is clearly *in-the-making*, and this "invisibility" might lead to further widening of the gap. Academic knowledge input of the patterns and determinants of energy injustice would increase awareness of the significance of the problem among transition actors, and further enable actions towards the tackling of social injustice in energy transitions. And vice versa, a lack of academic knowledge would make social injustice remain invisible, which further consolidate existing injustices in transition practices. In next section, we make a preliminary attempt to address this knowledge gap by offering a glimpse of emerging justice issues during energy transitions in China and the dynamics and characteristics of transition governance in authoritarian regimes.

Insert here Table 2: Emerging injustices of energy transitions by political regime type.

4. Energy transitions in China: authoritarian governance with adaptive characteristics

In this section, we use two representative cases of energy transitions in China to provide preliminary discussions on authoritarian transition governance and examine whether and to what extent this approach is doomed to breed social injustice. The rationale for choosing China as an exemplary case is twofold. First, China is among the countries where radical low-carbon energy transitions are taking place. In the past decade, China, as the largest greenhouse gas (GHG) emitter in the world, has made unprecedented progress in the development and application of low-carbon energies. From 2005 to 2015, China's annual consumption of renewable energy has increased from 166.00 million tce to 512.48 million tce (Huang and Liu, 2017). China's share in global renewables consumption increased from 3.27% in 2007 to 21.92% in 2017. China also leads in renewable energy investment, comprising 32.4% of global new investment in the year of 2016. Justice issues are more likely to emerge in more radical transition strategies. China thus serves as an ideal arena for the research purpose. Second, China is under authoritarian political regimes. Its transition governance is characterized by top-down, authoritarian approaches and is often called 'authoritarian environmentalism' (Beeson, 2009; Shen and Xie, 2018). With China's energy transitions taking place at an unprecedented scale, there are concomitant concerns about the induced (unintended) social consequences related to energy issues.

China has made remarkable achievements in the development of renewable energies, which are to a great extent obtained through a state-mandated strategy. Early in 2015, China has set the goal of lowering carbon dioxide emissions per unit of GDP by 60 to 65% from the 2005 level. Later in 2017, the *13th Five-Year Development Plan for Renewable Energy (2016–2020)* was published, in which it was estimated that till 2020 a total investment of 2.5 trillion CNY (about 0.4 trillion USD) will be allocated to the greening of its current energy system (Huang and Liu, 2017). These policies indicate strong government support for China's energy transitions, and a much more rapid transition toward renewable energy-based energy system in China is underway. Against this general background of low-carbon energy transitions in China, a series of policy strategies are introduced by multi-level governments. Based on document analysis, we present a preliminary discussion on two representative cases of authoritarian energy transitions in China: the mandatory implementation of building-integrated solar thermal (BIST) systems and the "coal to gas/electricity" initiative in northern China. The materials were mainly based on grey literature, ranging from professional journals that specialize in certain technologies (for instance the 'Solar Vision'), government documents and websites, to media articles.

Case 1: The mandatory implementation of building-integrated solar thermal (BIST) systems

The building sector is a main contributor to energy consumption and carbon emission in urban areas and building energy consumption accounts for 20.7% of the total end energy consumption in China (Cai et al., 2009). Therefore, the building sector is viewed as a vital arena for improving China's energy structure and applying renewable energy in buildings constitutes a crucial part of urban energy transitions (He et al., 2015). In August 2006, the Ministry of Housing and Urban-Rural Development (MoHURD) and Ministry of Finance (MoF) jointly issued the "Implementation Opinion on the Application of Renewable Energy in Buildings", stressing the necessity of scaling up the application of renewable energy in the building sector. BIST technology was specified as one of the key areas for implementation. In May 2007, the "Notice on Accelerating the Application of Solar Thermal Systems" was published by the National Development and Reform Commission (NDRC) and MoHURD, requiring provincial and urban governments to accelerate the application of BIST systems. The total application area of solar collectors was set to reach 150 million m^2 till 2010 and 300 million m^2 till 2020. Ever since, many areas in China started to enforce mandatory installation of BIST systems. According to incomplete statistics, till 2016, mandatory regulations had been enacted in 12 provinces and 25 cities in China. Most regulations require that for newly-built public and residential buildings under 12 floors, the BIST system needs to be designed, constructed, inspected and approved along with the building itself.

For multi-level governments in China, the mandatory installation regulation of BIST system was enacted under the ambition of accelerating the low-carbon energy transitions process. The policy making and enforcement of the mandatory installation regulation was in a rather top-down fashion and was highly objective-oriented. For instance, some provinces adopted a more radical strategy, set an annual application target of BIST system, and allocated the overall target to each city within its jurisdiction. Table 3 presents an example of this task assignment approach in Jiangsu Province. As can be seen, in 2018, Jiangsu Province aimed to accomplish the application of a total of 34.32 million m^2 BIST systems, including 30.4 million m^2 in residential buildings and 3.92 million m^2 in public buildings. This annual target was assigned to the 13 cities in the province. Under the pressure of the provincial government, the city governments are obliged to achieve the assigned targets. For many local governments, because they lack endogenous incentives to implement BIST technology, the mandatory policy is more like a political task assigned to them by higher level governments. Therefore, local governments often resort to its authority to govern more effectively and efficiently. For instance, real estate projects that fail to comply with the requirement of BIST installation will not be given permission for construction or completion inspection. The pressure was in this way passed on to real estate developers. This is a typical command-and-control governance approach, which although might be effective in some cases, has generated various justice issues.

Insert here Table 3: Annual target for the application of BIST system in Jiangsu province in 2018

For real estate developers, their primary concern was to make their projects greenlighted by the governments under the requirements of the mandatory installation of BIST systems, rather than to make sure that the installed facilities can function well. Therefore, under the absence of specific industry and product standards, in order to save construction costs, many developers chose cheaper BIST products over more qualified ones. For instance, in Muyang county in Jiangsu province, in the bidding for BIST installation in a real estate project, the developer selected four cheap brands with very poor qualities and after-sales services (Southern Weekly, 2008). In another case in Beijing, the developer intentionally designed a BIST system with so few solar collectors on the rooftops that it was impossible

to provide enough hot water for 480 households in the community[4]. In the city of Ningbo in Zhejiang province, installed BIST systems under the mandatory regulation were soon after dismantled and sold as wastes by users or sometimes even by real estate developers themselves (Ningbo Evening News, 2016). These cases indicate that the mandatory regulation has given birth to many so-called 'vanity projects'. In many real estate projects, the installed BIST systems were left unused. In Shenzhen, for instance, according to statistics released by the municipal government in 2015, among 250 BIST projects, 56 were left unused, involving a total investment of 90.79 million CNY[5].

Unfortunately, the costs were primarily transferred to end-users. In many cases, without prior notice, home buyers were simply told by developers that they had to pay for the installed BIST systems, as a package (Qilu Evening News, 2014). As can be seen, under the mandatory installation regulation, end-users have been largely excluded from the decision-making processes concerning what products to choose and how much to pay for. Moreover, the mandatory installation of BIST system seems to be more strictly and rigorously enforced in public housing projects. For instance, in Shenzhen, the municipal government required all the newly-built affordable housing be equipped with BIST systems (Shenzhen Economic Daily, 2012). As a result, more vulnerable households tend to bear more consequences of the policy. Complaints were reported from low-income households in social housing that it was too costly for them to use the installed BIST system (Daily Sunshine, 2013). In this sense, the costs for the energy transitions have been unfairly imposed on residents, especially on low-income social groups.

Various problems have invoked considerable criticism from the public. Urban residents' complaints revolve around the poor quality of the BIST products, the intransparency of the bidding process and higher utility bills for BIST facilities. They usually voice their complaints through informal platforms such as online forums and social media. The issue is also frequently covered by local newspapers and TV. In many areas, these voices were apparently heard by the government, leading to substantial adjustments of the policy. For instance, in Shenzhen, recognizing that the mandatory installation policy has created more problems than it has solved, the municipal government abandoned the policy eventually (Huang et al., 2018).

Case 2: The "coal to gas/electricity" initiative in northern China

For the Chinese government, low-carbon energy transitions offer solutions not only to climate change and carbon dioxide emissions, but also to the problem of environmental pollution (Zheng et al., 2015). Due to long-term and large-scale application of less environmentally friendly technologies in industries, environmental issues are getting more and more severe in China. The heavy smog in Beijing and many other mega cities is a typical example of serious air pollution and has gained widespread public attention. According to statistics in 2016, the air quality of 78.4% cities in China are not up to standard (State Council, 2016). With the promulgation of the famous "Air Ten Plan" (also called "The Action Plan on Prevention and Control of Air Pollution") in September 2013, the Chinese government started to get very serious in tackling air pollution. In the "Air Ten Plan", specific targets were set up for the year of 2017. The PM 2.5 level in the Beijing-Tianjin-Hebei (BTH) region, the Yangtze River Delta, and the Pearl River Delta in 2017 should have decreased 25%, 20% and 15% respectively compared to the level of 2012. Moreover, the PM 2.5 level of Beijing in 2017 should be controlled to around 60 mcg/m^3.

The BTH region has been a key area suffered from air pollution. In June 2016, with the approaching of the 2017 deadline set in the "Air Ten Plan", the Ministry of Environmental Protection (now the Ministry of Ecology and Environment) issued the "Strengthening Measures for the Prevention and Control of Air

[4] Solar Vision, Issue 61

[5] http://www.szaudit.gov.cn/zxbs/sjgzbg/jxsjgzbg/201512/P020151224839321671876.pdf

Pollution in BTH Region (2016-2017)", requiring key cities such as Beijing, Baoding and Langfang and responsible government departments to speed up the progress of "coal to electricity" and "coal to gas" initiative. In northern China, domestic coal heating is considered a main source for air pollution. In February 2017, the "2017 Work Plan for Air Pollution Control in BTH and Surrounding Areas" was issued, in which it was required that 28 cities in the BTH region (known as the "2+26" cities) to replace small coal-fired stoves by natural gas–fired or electric ones (Robinson et al., 2018). Later in August 2017, a complementary action plan was further published, in which it was specified that before October 2017, the replacement of coal-fired stoves should be completed for a minimum of 3 million households in the "2+26" cities. The four key cities of Beijing, Tianjin, Langfang and Baoding were required to construct the so-called "Coal-free Zones", in which the sale and use of coal are not allowed. This harsh policy specifically targeted the coming winter, to advance clean domestic heating in northern China and to ensure the fulfillment of the goal set in the "Air Ten Plan". However, the clean heating initiative was put forward without adequate preparations and many unintended consequences were incurred.

In the winter of 2017-2018, there occurred a serious natural gas shortage (The Beijing News, 2017). Although also influenced by other factors such as unexpected reduction in import supplies, the coal to gas heating conversion project was a main cause for the shortage, which has significantly increased the demand for natural gas (People's Daily, 2018; Robinson et al., 2018). Statistics show that the consumption of natural gas in 2017 has reached 235 billion m^3, with an unprecedented annual growth of 34 billion m^3 (ibid.). Since the beginning of public heating in November, natural gas supply could not meet surging domestic demand. Natural gas shortage not only caused unguaranteed winter heating, but also drove up the market prices and made it too expensive for many households to afford (South China Morning Post, 2017a). The situation was no better for those switching to electric stoves. Even with government subsidy, the cost of using electric stove is significantly higher than coal stove and is therefore beyond the financial ability of many low-income residents.

A combination of these unexpected situations has left many households without heat in the cold winter, which has provoked wide public discussion and media coverage, including international media. For instance, the *Guardian* published an article entitled "Poor bear brunt of Beijing coal cleanup with no heating at -6C", covering the experience of villagers living in Hebei Province (The Guardian, 2017). In the two villages the reporter visited, it was estimated that around two thirds of homes were not yet connected with natural gas supply after their coal stoves were dismantled by local governments. The *South China Morning Post* also published a series of reports on the unintended consequences of the aggressive "coal to gas" initiative, particularly a shortage of natural gas supply in hospitals and schools (South China Morning Post, 2017a, 2017b, 2017c, 2017d). Meanwhile, hashtags such as "coal to gas" and "gas shortage" trended quickly on the social media site *Sina Weibo*, China's largest micro-blogging service with more than 462 million monthly active users[6]. Many users shared their experiences of the coal ban in their hometown and criticized the government's "great leap forward" in clean heating and the inflexibility of the policy.

Under mounting pressures from the public, the central government reacted promptly to address the chaos generated by the hasty clean heating initiative. On December 4th 2017, an extra urgent official document was sent to authorities in the "2+26" cities by the Ministry of Environmental Protection and required the local governments to ensure winter heating of households. In areas where coal-fired stoves have been replaced by gas-fired stoves, gas supply priority should be given to civil use rather than industrial use. It also granted more flexibility to previous policies and stated that in areas where the "coal

[6] https://data.weibo.com/report/reportDetail?id=433

to gas/electricity" conversion project have not been completed, households are allowed to continue using coal-fired stoves without being penalized.

Overall, the above two cases demonstrate a political-oriented low-carbon transition in China. In order to address challenges of climate change and environmental pollution, the central government initiated nationwide campaigns of energy decarbonization in different sectors. Nevertheless, a mismatch clearly exists between national strategies and local social, political and economic contexts, and the command-and-control governance modality leaves local governments few spaces for context-based policy adjustments, leading to many unintended social consequences. The top-down, authoritarian governance approach inevitably created both distributional and procedural injustice. As for distributional injustice, in both cases, lower income social groups are more likely to be affected by the unintended consequences of transition policies. The coal to gas initiative, for instance, has apparently intensified energy poverty and inequality and hence reinforced existing injustices (Robinson et al., 2018). Hence, the costs of energy transitions are disproportionately born by more vulnerable social groups. While because of an institutional lack of opinion collection from a wide range of stakeholders, procedural justice is hard to attain under authoritarian political systems. Or more specifically, procedural justice is not something that can really be negotiated with. In this sense, social injustice seems to be an inevitable by-product of energy transitions in authoritarian regimes.

Nevertheless, to what extent these injustices are absolute remains an open question. For instance, the absence of direct participation of citizens in policy making does not equal to non-participation. In both cases, after serious social problems have been generated, both the media and the public engaged actively in discussions on the policy and the generated consequences, which have managed to exert considerable pressure on the government. The procedural injustice, therefore, is not in an absolute sense. In reality, the level of participation is contingent upon specific circumstances. Indirect participation via mass media and social media is observable in both cases. Key but generally 'invisible' stakeholders such as urban residents and villagers were given a voice through this indirect channel of participation. Through this way, public discourses and media did act as an indirect participatory and feedback mechanism that was possible to create a discursive influence upon the government and to further shape government decision-making. This indicates that although authoritarian governance is more apt to the creation of social injustices (particularly procedural injustice), it does have some kind of resilient feedback mechanism to help it adjust its decisions. Seen from a longer-term perspective, when a regime change is not on the table, a possible way forward for juster energy transitions in authoritarian regimes might lie in the governments' adaptive capacity and responsiveness.

Insert here Figure 1. The adaptive policy-making loop for advancing just energy transitions

As shown in figure 1, the policy-formulation loop (distribution->recognition->participation->redistribution) represents a form of adaptive governance. This process-oriented governance enables continuing adjustment of transition policies. If the initial round of *distribution* has caused unintended social consequences such as the unbalanced allocation of costs and benefit. It would be important for policy makers to recognize the induced social injustice, including identifying who have suffered from the induced injustices and whose interests have been violated. *Recognition* is of special relevance for the next step, *participation*. Gene rally, participation ensures meaningful involvement of every stakeholder in the decision-making process concerning energy transitions, which addresses the question of who are to be represented during the decision-making of energy transitions under the concept of procedural justice. Participation is also about obtaining information on different energy demand among users, and how to integrate diverse demands with the ultimate goal of low-carbon transitions. Notably, the extent of participation can be interpreted

differently in different contexts. In the case of China, feedbacks were sent back to the government through indirect participation of media coverage and public discussions. Eventually, under substantial public pressure, the government reacted promptly and made a U-turn in the policies, so as to limit the scale of unintended social consequences and injustice. This demonstrates a form of responsiveness and adaptability of transition governance. Eventually, energy policies reformulated under the recognition of induced injustices would generate a new round of distribution oriented towards juster outcomes (*redistribution*).

5. Conclusion

Advancing energy transitions is one of the great challenges facing human society in the twenty-first century. Recent years have witnessed the rise of social perspectives in energy transitions, represented particularly by the emerging discourse of just low-carbon energy transitions (Healy and Barry, 2017; Heffron and McCauley, 2018; McCauley et al., 2019). A just energy transition places social justice at the centre of energy transitions. The mission is to prevent the new wave of energy transitions from creating new or reinforcing old social injustices. Seen from a politico-institutional perspective, authoritarian regimes, because of the established tradition of command-and-control institutions, are considered as critical arenas for advancing a just transition globally.

Through a comprehensive case review of low-carbon energy transitions worldwide, the study presents a general picture of the emerging landscape of social injustices during the transition process of energy systems in the past decade. The case review points to an important and significant knowledge gap within existing literature that energy transitions under authoritarian governance are seldom studied from the justice perspective. Very little knowledge has been produced on the causes, patterns and implications of social injustice in authoritarian regimes. Responding to this gap, we present two representative cases of energy transitions in China. The cases reveal both the inevitable and the contingent aspects concerning justice issues under authoritarian regimes. First, low-carbon energy transitions in authoritarian regimes are inevitably accompanied by social injustice. This is deeply rooted in the institutional lack of participation and transparency in decision-making, a mismatch between national strategies and local, place-specific contexts, and limited flexibility for policy adjustments within the command-and-control governance modality. Despite this inescapability of social injustice, more nuanced perspectives in the interpretations of such injustice unveil the hidden 'contingent' facet of social injustice under authoritarian regimes. A responsive mechanism primarily through indirect participation of the public demonstrates the adaptive capacity of the government in transition governance in achieving juster outcomes of energy transitions. Advancing just low-carbon transitions is a continuous and progressive process. Seen from a longer-term perspective, a possible way forward for juster energy transitions in authoritarian regimes might, therefore, lie in the governments' adaptability in transition governance.

To initiate a socially just energy transition, it necessitates extensive scholarly input from both empirical and theoretical studies, so as to not only reveal existing barriers, but also to capture future opportunities. The authors call for more nuanced perspectives of justice issues that emerge in the process of energy transitions in authoritarian countries. It would be unrealistic and unfair to talk about social justice (in particular procedural justice) without considering the situated institutional contexts. In particular, indirect participation, as revealed in this study, might play an important role in formulating a responsive mechanism of transition governance, so as to facilitate a process of justice-oriented redistribution. More in-depth case studies are needed to enable more comprehensive and systemic thinking in just energy transitions.

References

Adams, J. S. (1965). Inequity in social exchange. *Advances in experimental social psychology*, *2*, 267-299.

Agyeman, J. (2008). Toward a 'just'sustainability?. *Continuum, 22*(6), 751-756.

Agyeman, J., Bullard, R. D., & Evans, B. (Eds.). (2003). *Just sustainabilities: Development in an unequal world*. MIT press.

Andrews-Speed, P. (2016). Applying institutional theory to the low-carbon energy transition. *Energy Research & Social Science*, 13, 216-225.

Axsen, J., & Kurani, K. S. (2012). Social influence, consumer behavior, and low-carbon energy transitions. *Annual Review of Environment and Resources, 37*, 311-340.

Barry, B. (1989). *Theories of justice* (Vol. 1). Univ of California Press.

Beeson, M. (2009). Developmental states in East Asia: a comparison of the Japanese and Chinese experiences. *Asian Perspective*, 5-39.

Bell, D. A. (2016). *The China model: Political meritocracy and the limits of democracy*. Princeton University Press.

Bickerstaff, K., Walker, G., & Bulkeley, H. (2013). Introduction: making sense of energy justice. *Bickerstaff K., Walker G. and Bulkeley H., Energy Justice in a Changing Climate, London, Zed Books*, 1-13.

Bridge, G., S. Bouzarovski, M. Bradshaw and N. Eyre (2013), 'Geographies of energy transition: Space, place and the low-carbon economy', *Energy Policy, 53*, 331-340.

Bulkeley, H., Carmin, J., Broto, V. C., Edwards, G. A., & Fuller, S. (2013). Climate justice and global cities: Mapping the emerging discourses. *Global Environmental Change, 23*(5), 914-925.

Bulkeley, H., Edwards, G. A., & Fuller, S. (2014). Contesting climate justice in the city: Examining politics and practice in urban climate change experiments. *Global Environmental Change, 25*, 31-40.

Cai, W. G., Wu, Y., Zhong, Y., & Ren, H. (2009). China building energy consumption: situation, challenges and corresponding measures. *Energy policy, 37*(6), 2054-2059.

Carroll, T., & SL Jarvis, D. (2013). Market building in Asia: Standards setting, policy diffusion, and the globalization of market norms.

Deng, G., & Kennedy, S. (2010). Big business and industry association lobbying in China: The paradox of contrasting styles. *The China Journal*, (63), 101-125.

Daily Sunshine. (2013). 公租房强制使用昂贵太阳能热水器？[Public rent housing is mandated to use costly solar water heaters?]. 08/06/2013. (in Chinese).

Economist Intelligence Unit (EIU). (2018). "Democracy Index 2017: Free Speech Under Attack." Economist Intelligence Unit. Available at: http://pages.eiu.com/rs/753-RIQ-438/images/Democracy_Index_2017.pdf.

Evans, A. (2010). The Public Chamber and Social Conflicts in Russia. In Western Political Science Association 2010 Annual Meeting Paper.

Evans, J. P. (2012). Environmental governance. Routledge.

Feygina, I. (2013). Social justice and the human–environment relationship: Common systemic, ideological, and psychological roots and processes. *Social Justice Research, 26*(3), 363-381.

Fuller, S., & McCauley, D. (2016). Framing energy justice: perspectives from activism and advocacy. *Energy Research & Social Science*, *11*, 1-8.

Gailing, L., & Moss, T. (Eds.). (2016). *Conceptualizing Germany's energy transition: institutions, materiality, power, space*. Springer.

Geels, F. W. (2002). Technological transitions as evolutionary reconfiguration processes: a multi-level perspective and a case-study. *Research policy*, *31*(8), 1257-1274.

Geels, F. W., & Schot, J. (2007). Typology of sociotechnical transition pathways. *Research policy*, *36*(3), 399-417.

Geels, F. W., Schwanen, T., Sorrell, S., Jenkins, K., & Sovacool, B. K. (2018). Reducing energy demand through low carbon innovation: A sociotechnical transitions perspective and thirteen research debates. *Energy research & social science, 40*, 23-35.

Gilley, B. (2012). Authoritarian environmentalism and China's response to climate change. *Environmental Politics*, *21*(2), 287-307.

Gross, C. (2007). Community perspectives of wind energy in Australia: The application of a justice and community fairness framework to increase social acceptance. *Energy policy*, *35*(5), 2727-2736.

Grubler, A. (2004). Transitions in energy use, in *Encyclopedia of Energy*, Volume 6, pp. 163–177.

Grubler, A. (2012). Energy transitions research: Insights and cautionary tales.*Energy Policy*, *50*, 8-16.

Gu, Q. (2014). Sina Weibo: A Mutual Communication Apparatus between the Chinese Government and Chinese Citizens. *China Media Research*, *10*(2).

Habich, S. (2015). *Dams, migration and authoritarianism in China: The local state in Yunnan*. Routledge.

Hager, C. (2015). Germany's Green Energy Revolution: Challenging the Theory and Practice of Institutional Change. *German Politics and Society, 33*(3), 1-27.

Harry, A. (2007). Wind turbines, noise and health. Available from: http: i'/www. f| atgroup. co. uk/pdf/wtnoise_health__2007_a_barry. pdf.

He, B., & Warren, M. E. (2011). Authoritarian deliberation: The deliberative turn in Chinese political development. *Perspectives on politics*, *9*(2), 269-289.

He, G., Zheng, Y., Wu, Y., Cui, Z., & Qian, K. (2015). Promotion of building-integrated solar water heaters in urbanized areas in China: Experience, potential, and recommendations. *Renewable and Sustainable Energy Reviews, 42*, 643-656.

Healy, N., & Barry, J. (2017). Politicizing energy justice and energy system transitions: Fossil fuel divestment and a "just transition". *Energy Policy*, *108*, 451-459.

Heffron, R. J., & McCauley, D. (2018). What is the 'just transition'?. *Geoforum*, *88*, 74-77.

Hekkert, M. P., Suurs, R. A., Negro, S. O., Kuhlmann, S., & Smits, R. E. (2007). Functions of innovation systems: A new approach for analysing technological change. *Technological forecasting and social change*, 74(4), 413-432.

Holtz, G., Brugnach, M., & Pahl-Wostl, C. (2008). Specifying "regime"—A framework for defining and describing regimes in transition research. *Technological Forecasting and Social Change*, *75*(5), 623-643.

Huang, P., & Liu, Y. (2017). Renewable Energy Development in China: Spatial Clustering and Socio-Spatial Embeddedness. *Current Sustainable/Renewable Energy Reports*, 1-6.

Huang, P., & Castán Broto, V. (2017). Urban energy transitions: spatial organization, political contestations and urban governance. *Handbook on the Geographies of Energy*, 380.

Huang, P., Broto, V. C., Liu, Y., & Ma, H. (2018). The governance of urban energy transitions: A comparative study of solar water heating systems in two Chinese cities. *Journal of cleaner production*, *180*, 222-231.

Huntington, S. P. (1970). Social and Institutional Dynamics of One-Party Systems. In S. P. Huntington and C. H. Moore (Eds.), *Authoritarian Politics in Modern Society: The Dynamics of Established One-Party Systems*, (pp. 3 – 47). New York: Basic Books.

Hyle, M. A. (2016). Conceptual reflection on responsive environmental governance. *International Journal of Public Administration*, *39*(8), 610-619.

Jenkins, K., McCauley, D., & Forman, A. (2017). Energy justice: A policy approach. *Energy Policy*.

Kern, F., & Smith, A. (2008). Restructuring energy systems for sustainability? Energy transition policy in the Netherlands. *Energy policy*, *36*(11), 4093-4103.

Kornreich, Y. (2016). Unorthodox approaches to public participation in authoritarian regimes: the making of China's recent health care reforms. In *Chinese Politics as Fragmented Authoritarianism* (pp. 89-109). Routledge.

Lee, J., & Byrne, J. (2019). Expanding the Conceptual and Analytical Basis of Energy Justice: Beyond the Three-Tenet Framework. *Frontiers in Energy Research*, *7*, 99.

Lenoble, J. (2005). Open method of coordination and theory of reflexive governance. *Social rights and market forces: Is the open coordination of employment and social policies the future of social Europe*, 19-38.

Ling, W. U. (2017). Urban Renewal and Spatial Justice in China's Changing Urban Governance. *Canadian Social Science*, 11(8), 11-15.

Lo, K. (2015). How authoritarian is the environmental governance of China?. *Environmental Science & Policy*, *54*, 152-159.

Loorbach, D. (2007). Transition management. *New mode of governance for sustainable development. Utrecht: International Books*.

McCauley, D., & Heffron, R. (2018). Just transition: integrating climate, energy and environmental justice. *Energy policy*, *119*, 1-7.

McCauley, D. A., Heffron, R. J., Stephan, H., & Jenkins, K. (2013). Advancing energy justice: the triumvirate of tenets. *International Energy Law Review*, *32*(3), 107-110.

McCauley, D., Ramasar, V., Heffron, R. J., Sovacool, B. K., Mebratu, D., & Mundaca, L. (2019). Energy justice in the transition to low carbon energy systems: Exploring key themes in interdisciplinary research. *Applied Energy*, 233-234, 916-921.

McEwan, C. (2017). Spatial processes and politics of renewable energy transition: Land, zones and frictions in South Africa. *Political Geography*, 56, pp. 1-12.

Meadowcroft, J. (2009). What about the politics? Sustainable development, transition management, and long term energy transitions. *Policy sciences, 42*(4), 323.

Mertha, A. (2009). "Fragmented authoritarianism 2.0": Political pluralization in the Chinese policy process. *The China Quarterly*, *200*, 995-1012.

Miller, C. A., Iles, A., & Jones, C. F. (2013). The social dimensions of energy transitions. *Science as Culture*, *22*(2), 135-148.

Mol, A. P., & Carter, N. T. (2006). China's environmental governance in transition. *Environmental politics*, *15*(02), 149-170.

Musiolik, J., Markard, J., & Hekkert, M. (2012). Networks and network resources in technological innovation systems: Towards a conceptual framework for system building. *Technological Forecasting and Social Change, 79*(6), 1032-1048.

Naisbitt, J., & Naisbitt, D. (2010). *China's megatrends: The 8 pillars of a new society*. Harper Collins.

Newell, P., & Mulvaney, D. (2013). The political economy of the 'just transition'. *The Geographical Journal*, *179*(2), 132-140.

Ningbo Evening News. (2016). 崭新的太阳能热水器为何当废品卖？ [Why brand-new solar water heaters were sold as wastes?]. 06/21/2017. (in Chinese). Available at: http://news.dichan.sina.com.cn/2016/06/21/1200277.html

Nip, J. Y., & Fu, K. W. (2016). Challenging official propaganda? Public opinion leaders on Sina Weibo. *The China Quarterly*, *225*, 122-144.

Pandve, H. T. (2009). India's national action plan on climate change. *Indian journal of occupational and environmental medicine, 13*(1), 17.

Pearce, J. L., Bigley, G. A., & Branyiczki, I. (1998). Procedural justice as modernism: Placing industrial/organisational psychology in context. *Applied Psychology, 47*(3), 371-396.

People's Daily. (2018). 气荒如何不再来？——对今冬大面积气荒的调查与思考 [How to avoid natural gas shortage again? Reflections on large-scale natural gas shortage in this winter]. 02/05/2018. (in Chinese).

Qilu Evening News. (2014). 四问太阳能“强装令”[Four inquiries on the mandatory installation regulation of solar thermal systems]. 04/09/2014. (in Chinese).

Rauchfleisch, A., & Schäfer, M. S. (2015). Multiple public spheres of Weibo: A typology of forms and potentials of online public spheres in China. *Information, Communication & Society*, *18*(2), 139-155.

Raven, R., J. Schot and F. Berkhout (2012), 'Space and scale in socio-technical transitions', *Environmental Innovation and Societal Transitions*, 4, 63-78.

Rawls, J. (1971). *A Theory of Justice*. Harvard University, Cambridge, Massachusetts.

Reames, T. G. (2016). Targeting energy justice: Exploring spatial, racial/ethnic and socioeconomic disparities in urban residential heating energy efficiency. *Energy Policy*, *97*, 549-558.

Roberts, N. (2004). Public deliberation in an age of direct citizen participation. *The American review of public administration*, *34*(4), 315-353.

Robinson, C., Yan, D., Bouzarovski, S., & Zhang, Y. (2018). Energy poverty and thermal comfort in northern urban China: A household-scale typology of infrastructural inequalities. *Energy and Buildings*, *177*, 363-374.

Rutherford, J. and O. Coutard (2014), 'Urban energy transitions: Places, processes and politics of socio-technical change', *Urban Studies, 51*, 1353-1377.

Sakellariou, N. (2013). A Framework for Social Justice in Renewable Energy Engineering. In *Engineering Education for Social Justice* (pp. 243-267). Springer Netherlands.

Schot, J., & Geels, F. W. (2008). Strategic niche management and sustainable innovation journeys: theory, findings, research agenda, and policy. *Technology analysis & strategic management*, *20*(5), 537-554.

Shen, W., & Xie, L. (2018). The Political Economy for Low-carbon Energy Transition in China: Towards a New Policy Paradigm?. *New Political Economy*, 23(4), 407-421.

Shenzhen Economic Daily. (2012). 深圳：新建保障房全部安装 太阳能热水系统 [Shenzhen: Newly built social housing will all be equipped with solar hot water systems]. 06/07/2012. (in Chinese).

Shi, H., & Zhang, L. (2006). China's environmental governance of rapid industrialisation. *Environmental politics*, *15*(02), 271-292.

Simcock, N. (2016). Procedural justice and the implementation of community wind energy projects: A case study from South Yorkshire, UK. *Land Use Policy, 59*, 467-477.

Solomon, B. D., & Krishna, K. (2011). The coming sustainable energy transition: History, strategies, and outlook. *Energy Policy*, *39*(11), 7422-7431.

South China Morning Post. (2017a). Pollution fight cold comfort for families without heating in northern China. 11/22/2017. Available at: https://www.scmp.com/news/china/policies-politics/article/2120958/pollution-fight-cold-comfort-families-without-heating

South China Morning Post. (2017b). Natural gas crunch in northern China leaves hospitals, schools out in the cold. 12/04/2017. Available at: https://www.scmp.com/news/china/policies-politics/article/2122834/natural-gas-crunch-northern-china-leaves-hospitals

South China Morning Post. (2017c). Move to clean energy leaves Chinese pupils out in the cold winter. 12/05/2017. Available at: https://www.scmp.com/news/china/society/article/2122964/move-clean-energy-leaves-chinese-pupils-out-cold-winter

South China Morning Post. (2017d). China U-turns on coal ban amid growing outcry over numbers left freezing in winter cold. 12/07/2017. Available at: https://www.scmp.com/news/china/policies-politics/article/2123270/china-u-turns-coal-ban-amid-growing-outcry-over-numbers

Southern Weekly. (2008). 劣币驱逐良币？太阳能推广引争议 [Bad money drives out good? The controversial implementation of solar hot water systems]. 08/21/2008. (in Chinese). Available at: http://info.hvacr.hc360.com/2008/08/26144995310-2.shtml

Sovacool, B. K., Burke, M., Baker, L., Kotikalapudi, C. K., & Wlokas, H. (2017). New frontiers and conceptual frameworks for energy justice. *Energy Policy, 105*, 677-691.

Sovacool, B. K., & Dworkin, M. H. (2015). Energy justice: Conceptual insights and practical applications. *Applied Energy*, *142*, 435-444.

State Council. (2016). 国务院关于印发“十三五”生态环境保护规划的通知 [Notice of the State Council of the 13th Five-Year Plan for Ecological Environment Protection]. No. SC [2016]65, 24 November 2016. http://www.gov.cn/zhengce/content/2016-12/05/content_5143290.htm.

Stegen, K. S., & Seel, M. (2013). The winds of change: How wind firms assess Germany's energy transition. *Energy Policy, 61*, 1481-1489.

Steiner, D. D. (2001). Cultural influences on perceptions of distributive and procedural justice. *Theoretical and cultural perspectives on organizational justice*, 111-137.

Stoker, G. (1998). Governance as theory: five propositions. International social science journal, 50(155), 17-28.

The Beijing News. (2017). 煤炉撤了天然气却没来，“气荒”是怎么造成的？[The coal-fired stoves were removed but the gas did not come. What has caused the natural gas shortage?]. 12/04/2017. (in Chinese).

Jiangsu Provincial Housing and Urban-Rural Development Department. (2018). 省住房和城乡建设厅关于印发《2018 年全省 建筑节能与绿色建筑工作任务分解方案》的通知 [Notice of the Jiangsu Provincial Housing and Urban-Rural Development Department on the Task Assignment Plan for the Implementation of Building Energy-saving and Green Buildings in Jiangsu Province in 2018]. 05/24/2018. (in Chinese).

The Guardian. (2017). Poor bear brunt of Beijing coal cleanup with no heating at -6C. 12/04/2017. Available at: https://www.theguardian.com/world/2017/dec/04/poor-bear-brunt-beijing-coal-cleanup-with-no-heating-at--6c

Truffer, B., & Coenen, L. (2012). Environmental Innovation and Sustainability Transitions in Regional Studies. *Regional Studies, 46*(1), 1-21.

Turnheim, B., Berkhout, F., Geels, F., Hof, A., McMeekin, A., Nykvist, B., & van Vuuren, D. (2015). Evaluating sustainability transitions pathways: Bridging analytical approaches to address governance challenges. Global Environmental Change, 35, 239-253.

Voss, J. P., Bauknecht, D., & Kemp, R. (Eds.). (2006). *Reflexive governance for sustainable development*. Edward Elgar Publishing.

Wang, H., & Shi, F. (2018). Weibo use and political participation: the mechanism explaining the positive effect of Weibo use on online political participation among college students in contemporary China. *Information, Communication & Society*, *21*(4), 516-530.

Wodrig, S. (2018). New subjects in the politics of energy transition? Reactivating the northern German oil and gas infrastructure. *Environmental Politics, 27*(1), 69-88.

Yenneti, K., & Day, R. (2015). Procedural (in) justice in the implementation of solar energy: The case of Charanaka solar park, Gujarat, India. *Energy Policy*,*86*, 664-673.

Yenneti, K., & Day, R. (2016). Distributional justice in solar energy implementation in India: The case of Charanka solar park. *Journal of Rural Studies*, *46*, 35-46.

Young, I. M. (2011). *Justice and the Politics of Difference*. Princeton University Press.

Zheng, S., Yi, H., & Li, H. (2015). The impacts of provincial energy and environmental policies on air pollution control in China. *Renewable and Sustainable Energy Reviews*, *49*, 386-394.