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Towards Sustainability in Trade, Energy and Climate

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Abstract: This paper aims at developing effective trade law and policy instruments for sustainable energy and environmental protection with a view to advance current legislation. In the past, trade law has been a very powerful instrument for change in other fields of science. My hypothesis is that trade law can be a tool to help mitigate climate change and enhance sustainable energy. And it is well known that, thanks to trade, countries grow economically. Hence, the triple benefit of trade, which can have a positive economic, environmental and social impact.

This paper challenges the view that trade's only impact on the environment is negative. On the contrary, it takes the unconventional view that the trading system goes beyond benefiting the economy and society in that it can also contribute to environmental protection, with a specific focus on decarbonization, which is one of the main challenges humanity faces today. In this sense, my research proposes a paradigm shift in how we approach trade and develops a new theory based on the triple benefit of trade. This papaer incorporates the new trend of bottom-up, rather than top-down, solutions to today's global challenges. My analysis of trade's potential for environmental protection will:

- Shift the scientific paradigm that trade's only impact on the environment is negative by proposing the novel idea of using mega-regional trade agreements (RTAs) to mitigate climate change and enhance sustainable energy;
- Explain that a bottom-up approach to governance can give us many answers to scientific issues by bringing forward the novel idea of how greater participation of citizens can be very promising in helping achieve the Sustainable Development Goals (SDGs).

Such an approach will show the potential of the trading system for moving forward many of the SDGs and is likely to create new opportunities and open new windows for further research.

Key words: international trade, climate change, energy, sustainability

1. Introduction

The increasing role of new actors in law-making has received attention since the 1990s [1-3]. Developments in climate change and environmental law in this era have catalyzed innovative governance approaches by non-State actors and international organizations. These developments have created new legal challenges, both public and private, in a global multilevel governance context. New actors are not solely involved in contributing to thematic law and policy agenda setting, developing solutions, and providing oversight capacity; they are also becoming important players in delivering services. Opportunities to deliver services are growing as the global economy reconfigures around advancing information and communications technologies illustrated by the rapidly emerging "gig" economy [4].[1]

In this new setting, ample space is created for the emergence of new energy actors, a principal one being prosumers, namely consumers who are also producers of (renewable) energy and who use energy in a smarter and more efficient manner. Energy prosumers is an umbrella term referring to self-generating energy providers, whether households or energy communities. Individuals contribute to the energy supply in their vicinity via their community-owned own-installed renewable energy capacity, more often than not solar roofing, wind energy, or combined heat and power [5].

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[1] "A gig economy is an environment in which temporary positions are common and organizations contract with independent workers for short-term engagements."

This paper critically analyses the new challenges and opportunities that prosumers bring to achieving energy security goals in the European Union (EU). The EU, along with the United States (US) [6],[2] is a pioneer in engineering a hybrid electricity market model, where traditional power plants will be supplemented by virtual power plants, a plethora of small, individual energy producers and a corresponding new set of mechanisms to cater for the new market. That said, the adoption and customisation of (elements of) this new energy architecture by other countries will hinge upon the degree of its success within European soil. This paper contributes to the literature in two specific ways. First of all, it critically discusses an emerging new actor in the EU's energy security that we refer to as prosumers. Second, it illustrates in broad terms the ways in which this new actor will cooperate with other actors in the EU energy market and contribute to the European Union's energy goals.

In this context, side by side with traditional threats and challenges, new risks, but also opportunities, arise for ensuring energy security [7]. The energy sector is undergoing a large-scale low-carbon transition. What is under-emphasized in this transition is that it involves a major paradigm shift from a supply-driven to a demand-side energy policy. Driven by a mix of geopolitical, economic, climate, and technological considerations, the energy sector is moving towards a new architecture [8, 9],[3] the principal pillars of which are progressive electrification, a cleaner energy mix, renewable indigenous energy production, increased energy efficiency, and the development of new markets to produce, transmit, and, crucially, manage energy [10].[4] The key to this overhaul is the slow, but already underway, development of prosumer markets.

The paper analyzes one of the mega-trends of the 21st century, namely a paradigm shift in the governance of sustainability from the bottom up. It critically analyzes the role of citizens in international trade, energy transition, and climate action and favors the empowerment of citizens in this respect. The paper concludes with a future research agenda to fill the knowledge gap on the links between four major global concerns: trade, energy, climate change, and sustainability.

2. Megatrends of the 21st Century [11]

The scientific community is by now in almost unanimous agreement that the greenhouse gas (GHG) effect is real [12], and the level of GHG emissions in the atmosphere continues to increase [13]. There are clear policy actions to tackle climate change: mitigation [14][5], adaptation [15][6], and geoengineering [16][7]. As a result of the Paris Agreement, and prior to the signing of the Paris Agreement, new avenues to tackle climate change more effectively have emerged, such as the involvement of mayors [17, 18][8], governors

[2] In the case of the US, new legislation plans (known as the Affordable Clean Energy (ACE) rule) try to move away from coal-fired generation, which is driven by fundamental economics. Under the Affordable Clean Energy rule (which replaces the Obama administration's Clean Power Plan (CPP), whose aim was to set federal guidelines for states to reduce their CO_2 emitted by power generators), states will be able to set less strict standards, even having no CO_2-emissions reductions targets at all. Coal can be included as part of the energy mix. The CPP, however, sought to reduce CO_2 emissions from power plants by 32% from their levels in 2005 by 2030. With the ACE rule, the level of CO_2-emissions reduction is expected to be minimal.

[3] All these issues could be placed together under the concept of *ecological economics*, which addresses the relationships between ecosystems and economic systems in the broadest sense. The main aims of ecological economics are:

- Establishing a historical perspective on social-natural interactions;
- Finding a common language and a set of concepts for the analysis of economies and ecosystems;
- Studying the intersection between natural science and social science.

[4] For an overview of the current legal and policy situation in EU energy.

[5] For example, by reducing the emissions of GHGs in the atmosphere with the promotion of electric cars or making use of the circular economy.

[6] For example, by minimizing the damage caused by the effects of climate change; a case in point is using scarce water resources more efficiently.

[7] For example, by enhancing surface brightness, such as painting roofs white.

[8] Several cities throughout the world have agreed to make new buildings carbon-neutral from 2030 and to retrofit others to the same standards by 2050. The mayor of London Sadiq Khan has promised to make London zero-carbon by 2050.

[18-20][9], and CEOs [21]. From this perspective, the Paris Agreement combines the action of both state and non-state actors during the negotiating phase and in its implementation.

Cities should take climate action because today the majority of the world's population lives in cities [22], and this trend to urban migration is on the rise [23][10]; because they are the main polluters and the main implementers of legislation [19]; and because mayors of cities are pragmatic with global issues such as climate change, poverty, and terrorism [24]. Such issues are also too big for nation-states, and cities arguably offer better governance on these matters [25] [11] . Furthermore, some of the greatest environmental and social challenges come from cities: food, water, waste, infrastructure, transport. Moreover, mayors tend to come from the cities they govern [25] and therefore have a much higher level of trust than politicians at the national level [25]. All of this means that using cities to mitigate climate change is a promising initiative, so educating citizens and raising awareness become crucial.

Global issue governance at city and local levels is on the rise. Some of these initiatives even go beyond climate action and have collateral effects such as job creation and prevention of premature pollution-related deaths. Examples of such bottom-up structures are: the C40 Mayors Summits [26]; the Compact of Mayors [27]; the Covenant of Mayors for Climate and Energy [28];[12] the Global Covenant of Mayors for Climate and Energy [28]; RESURBE [29]; the "100 resilient cities" scheme pioneered by the Rockefeller Foundation [30]; United Cities and Local Governments [31]; International Council of Local Environmental Initiatives [32]; CityNet [33]; City Protocol [34]; the United States Conference of Mayors; Habitat III [35]; and the Making Cities Resilient campaign[36] in the framework of the U.N. Office for Disaster Risk Reduction [37]. All of these examples show that, until recently, there has been a legal and policy vacuum at the city level regarding climate action and that city networks for climate deliberation are on the rise. It also means that there is a lot that cities can do even when national governments refuse to act on climate change or other global issues. This could even lead to the creation of a "[L]eague of [C]ities", to quote the American political theorist Benjamin Barber [38].

Mayors' and governors' plans of action for climate change mitigation and adaptation could be emulated in other cities and regions of the world with similar concerns. For instance, the mayor of Rio de Janeiro, Brazil, may have a plan to mitigate climate change that is opportune for Manila, Philippines. To make sure that intercity networks remain coordinated, there have been proposals for the creation of a Global Parliament of Mayors [38] to enable cities to have a stronger voice on global issues and address global priorities more democratically and directly by citizens [38]. The purpose is to democratize globalization or to globalize democracy [38].

Moving forward, the international community may also consider putting a price on harm-causing [39][13]. Addressing climate change will require such top-down, centralized guidance from intergovernmental decisions and bottom-up, decentralized implementation of climate change goals through companies and citizens' participation. Both approaches are necessary to succeed. Although national action is not a prerequisite for local intervention on climate change, it certainly helps get things done more efficiently. For the

[9] In September 2018, California's governor, Jerry Brown, issued an executive order to make California carbon-neutral by 2045. Moreover, as of September 2018, Utah was considering a carbon tax.

[10] By 2050, 70% of the world's population is expected to live in cities.

[11] For further details on the potential of cities to solve global problems locally, see Benjamin R. Barber 2013), arguing that local executives exhibit a nonpartisan and pragmatic style of governance that is lacking in national and international halls of power.

[12] The idea behind the Covenant is to support local authorities in the implementation of local sustainable energy policies.

[13] For an example of a recent domestic approach proposed in the United States by a group of senior Republican (among them, two former secretaries of state and of the treasury, namely James Baker and George Shultz).

implementation of any policy, good legislation is key. Incomplete policy is non-implementable policy.

Expanding clean energy choices is also an increasingly popular issue because clean energy is an effective way to decarbonize the economy and it is therefore necessary to find a way to finance it [40]. As a result of clean energy's popularity, there is an innovation race across the world [41, 42]. It is necessary to create a policy framework for innovators to be willing to accept failure and not be afraid of making mistakes to encourage continued development.

All of these trends raise the interesting question of how to manage globalization in a sustainability era. Table 1 below offers the main trends of the 21st century in a sustainability context.

In January 2017, the U.S. National Intelligence Council (NIC) published its public Global Trends Report titled Global Trends: The Paradox of Progress. Through 2035, the NIC noted that the global trends of climate change, the environment, and public health issues "will demand attention" [43].

3. A Paradigm Shift in the Governance of Sustainable Development: Citizens' Empowerment

3.1 From Top-down to Bottom-up Governance

Multilateralism does not seem to be doing well these days [44, 45][14]. Arguably, sometimes one needs unilateralism to improve multilateralism. The US intends to withdraw from the Paris Agreement on Climate Change [46, 47][15] and President Trump questions the validity of the US contribution to the UN; multilateral trade negotiations at the WTO seem to go nowhere and the WTO's dispute settlement system is stagnated [48][16]. It seems as if the WTO has not been up to par with economic change. State-centricity seems to be making people unhappy. There seems to be a fundamental lack of trust in current governance structures.

Table 1 Megatrends of the 21st Century[17]

20th Century	21st Century
Focus of attention was government	Focus of attention should be business.
Environmental information silos; little attention to economics	Since *vox populi* is that economics will always prevail over the environment, it is necessary to have an integrated approach between the environment, energy, and the economy. The international trading system unites the three sectors.
Top-down approach to climate change mitigation through participation of presidents and prime ministers of countries	Bottom-up approach to climate change mitigation through participation of citizens, mayors, governors, CEOs, and billionaires.
Command and control approach; "polluter pays" principle	Market mechanisms; economic incentives not to pollute.
Prohibitions	Problem-solving.
Good consumers were not rewarded	Reward individuals who solve problems.
Gurus gave prescriptions on how to move forward	Big data [49][18] usage for better analysis to inform decisions.
Success was based on money expenditure	Success is based on outcomes and implementation.
Environmental protection as a moral good	Price-based approach to punish environmental harm.
Innovation in technology	Innovation in government and finance.
Limited infrastructure	Technological revolution: using technology to help with infrastructure.

[14] The US has been withdrawing from a number of multilateral fora since President Trump came to office. As of June 2018, the most recent example was the withdrawal from the UN Human Rights Council. In September 2018, it was announced that the Trump administration was keen to reform the International Postal Union, which regulates the international postal system.

[15] In accordance with Article 29 of the Paris Agreement, it takes four years to withdraw from the Agreement. Interestingly, Mr Trump's intention to quit the Paris Agreement happens to be one day after he faces re-election in 2020.

[16] US Trade Representative Robert Lighthizer has repeatedly made the point that the WTO needs to be reformed and that US trade policy has gone in the wrong direction since the creation of the WTO.

[17] This list is based on a "Decalogue" developed by Daniel Esty of Yale University, First Yale Sustainability Leadership Forum, September 2016 at Yale University.

[18] The current situation regarding barriers with data collection tends to be as follows: 1) unavailable data; or 2) available data, but owner are unwilling to share; or 3) available data, but we need greater expertise on how to make better use of big data for better policymaking.

All of this puts into question the hegemonic stability theory that predicates that the international system is most likely to be stable when a single state is the dominant power in the world [50]. Based on the view that one should never waste a crisis to reach reform, would it be the right time to think of alternative ways of governance? It is often the case that what citizens think is overlooked by policymakers. Would greater involvement of citizens make a difference for a better and more effective global economic governance? Big crises can lead to big reforms and positive developments.

A top-down guidance to sustainable development will come from inter-governmental decisions [51, 52] (i.e., high level of abstraction) [53-65], whereas a bottom-up approach means that action/implementation will happen from consumers'/citizens' participation (i.e., low level of abstraction) [66-68]. National governments are essential, but are no longer the only key actors. This raises the question whether cities [69-72] [19] can make effective change if national governments do not deliver. At what point should businesses have to step up if politicians fall short? Cities around the world are demonstrating innovative strategies for advancing solutions to climate change. Via this bottom-up approach to governance, citizens can ask states for reform.

In the case of international trade, during the WTO Ministerial Conference in Seattle in 1999 there were large crowds of people angrily demonstrating on the streets, asking trade technocrats to be transparent and share the outcome of multilateral trade negotiations that were happening behind closed doors. Those were the days when multilateral trade was sexy. More recently, with the rise of mega-regional trade agreements (as examples of plurilateralism, which seems to be the way forward in international trade) [73] [20] such as the Comprehensive and Progressive Agreement for Trans-Pacific Partnership (CPTPP), [21] there have been large demonstrations on the streets of the US, UK [74] [22], Germany, and Austria against the Trans-Pacific Partnership (in the case of the US) and the Trans-Atlantic Trade and Investment Partnership [TTIP] (in the case of the other countries). All of this shows an increasing interest among citizens in international trade negotiations, who are concerned that the outcome of such negotiations may affect their daily life negatively as a result of "openness to investment from other members, the protection of patents, and environmental safeguards" [75].

Softer, informal tools of governance, rather than treaties, seem to be central to the current crisis/transformation of multilateral governance. In the field of energy governance, regulatory alignment, technology alignment, and building common institutions might all help enhance sustainable energy [76]. New actors are emerging. One of them is the citizens.

[19] There is a vast body of literature on sustainable cities. A sustainable city should meet the needs of the present without sacrificing the ability of future generations to meet their own needs.

[20] The following is evidence that plurilateralism, as opposed to multilateralism, seems to be the way forward in international trade negotiations: In December 2017, during the WTO Ministerial Conference in Buenos Aires, some, but not all, WTO Members (therefore, making this procedure an example of plurilateralism) issued joint statements that were signed by subgroups of WTO Members. The aim of these plurilateral statements was to deal with specific topics, including informal work programs for Micro, Small and Medium Enterprises (WT/MIN(17)/58/Rev.1), investment facilitation (WT/MIN(17)/59), electronic commerce (WT/MIN(17)/60), fossil fuel subsidies (WT/MIN(17/54)), as well as on services domestic regulation (WT/MIN(17)/61) within the WTO Working Party on Domestic Regulation. For an analysis of plurilateral governance in climate change, see Ref. [73].

[21] After the US decided to withdraw from the Trans-Pacific Partnership, which never entered into force, it was agreed in January 2018 that negotiations would start on a new trade agreement called the Comprehensive and Progressive Agreement for Trans-Pacific Partnership. To see the newly agreed text, visit https://www.mfat.govt.nz/en/trade/free-trade-agreements/free-trade-agreements-concluded-but-not-in-force/cptpp/comprehensive-and-progressive-agreement-for-trans-pacific-partnership-text/#chapters. Crucial side letters were not yet available as of February 2018.

[22] Anecdotally, it is interesting to note that more people signed an anti-TTIP campaign in the UK — which is known as a free-trade country — than in France — which is known as a protectionist nation [74].

3.2 New Concept: Citizen Empowerment

Citizens' empowerment is a relatively new concept in global governance. Empowering citizens has implications for societal change as it provides a human element to governance [77]. More direct participation by citizens is increasingly necessary to reach good governance. In the field of energy governance, one of the aims of this section is to explore how to effectively place citizens at the center of the transformation of the grid by allowing greater citizen participation and access to information. Citizen participation will bring stability, facilitate citizens' wellbeing, provide better access to energy, it will put pressure on companies to do the right thing [78-86], and provide better management of climate change and environmental issues. By doing so, we are moving away from energy poverty towards a transition to energy democracy [87, 88],[23] energy citizenship [89], decentralized energy [90], sustainable energy enhancement [91], more effective climate change mitigation and greater presence of citizens in trade policy/diplomacy.

Since more prosumers are entering the market, all of this, in turn, will lead to the creation of scalable micro-grids for prosumers [92] and utility companies, new policies and regulatory frameworks for smart grids, as well as a better grid management [93].[24] It will also encourage prosumers towards a more energy-efficient behavior. Further, it will change citizens' attitudes from being passive to active consumers by presenting a variety of local engagement opportunities. Local renewable energy communities are at the grassroots of the movement to change the current energy-security system. For instance, how can legal technical barriers to energy technology [94-96] be reduced or eliminated for smart grids to take off in different jurisdictions? [97][25] How could the legal environment be developed to benefit technology and create, say, a single smart grid in supranational structures like that of the EU? [98, 99][26] Such a system would make energy security cheaper and consumers would be able to control and manage their energy bills.

The use of behavioral economics in public policy has been increasingly on the agenda. In energy policy, "it has become clear that efforts to steer people towards "better" — that is, more energy efficient — choices and behaviours are much needed."[100] As suggested by Lucia Reisch, there is increasing evidence that the right incentives do spur behavioral change [100]. This has certainly been the case in Nordic countries, where the so-called Nordic model has failed in top-down policies (such as the creation of common defense policy, a single currency), but has been very successful in the design of bottom-up approaches to policies with the right incentives and market integration [101].

This shift in the governance of sustainable development implies putting citizens at the center of this process. The phenomenon of what we describe as a "bottom-up approach" to the *democratic* [102-104] implementation of climate change mitigation plans is one of the mega-trends of the 21st century.[27] Since the majority of the world population lives in cities [105] (and this trend is on the rise) [23],[28] since 50% of global waste is produced in cities [106], since 80% of global economic activity takes place in cities [107-110],[29] since the urban heat island effect is a

[23] The concept of *Energiewende* describes Germany's efforts to move away from fossil fuels and nuclear power by promoting renewable energy instead, whilst remaining a major industrial power.

[24] A UK National Infrastructure Commission report states that "smart power" could save consumers up to £8bn per year by 2030 via smart grid demand management, energy storage, and interconnectors [93].

[25] According to Stanford University researchers, "utilities around the world can rely on multiple methods to stabilize their electricity grids in a shift to 100% wind, solar, and hydroelectricity." [97]

[26] For an initiative in this direction towards energy cooperation between the North Seas countries, see Ref. [98], Similar thinking is taking place for the creation of a single, shared 5G wireless network, see Ref. [99].

[27] A creation of the Paris Agreement, which has become the locomotive of climate action.

[28] By 2050, 70% of the world's population is expected to live in cities [23].

[29] As measured by global Gross Domestic Product (GDP) [107]. For various analyses of cities as centers of human interaction, see Refs. [108-110].

fact,[30] since cities consume about 75% of global primary energy [116], and since between 60% and 80% of GHG emissions comes from cities [117], this new mega-trend of climate action at the city level with a much greater participation of citizens is very promising [118]. However, when trying to get to 100% green energy, many cities may have to import power from rural and offshore areas, where space is less of an issue than in cities [119][31].

So why should cities (and therefore citizens) take climate action? Because cities are the main polluters and the main implementers of legislation [19]; and because mayors of cities are pragmatic with global issues such as climate change, poverty or terrorism [24]. Also because such issues are too big for nation-states and because cities arguably offer better governance on these matters. Moreover, mayors tend to come from the cities they govern and therefore have a much higher level of trust than politicians at the national level.

What should be the role of citizens in the shift towards a circular economy (i.e., recycling and reusing products) and in trade diplomacy? What should be the role of the emerging environmental goods and services sector? In the specific case of international trade, one could imagine as citizens' empowerment the involvement of civil society, as stakeholders of trade agreements, in committees on trade and environment via their participation during the negotiation process of future trade agreements. Moreover, with the rise of e-commerce, one could think of the increasing participation of micro, small and medium enterprises via apps on their smartphones. How can trade policy have more contact with private companies that are involved in international trade? Regarding the process of negotiation of trade agreements, however, there are technical barriers to bringing participation to the grassroots level. Potential areas for improvement and participation at the grassroots level are transparency,[32] NGO involvement, the implementation of trade agreements, information asymmetry, and due process, among others.

Following the so-called Thünen's model of agricultural land [120][33], one can think of the

[30] The urban heat island effect explains why urban areas are significantly warmer than rural areas due to anthropogenic activity. On the links between climate change and anthropogenic activity, see Ref. [111]. In 120 years, world population has increased five-fold: from 1.5 to 7.5 billion. By 2030, around 60% of the world population may be living in cities. Urban growth is a multiplier of human impacts. Cities typically increase living standards as well as impacts. The so-called "I = PAT" equation is the mathematical notation of the formula $I = P \times A \times T$ that describes the impact of human activity on the environment, where "I" represents the environmental impact, "P" population, "A" affluence, and "T" technology. Society has changed over the centuries, from living in the agropolis (i.e., a city of around 20,000 people, surrounded by concentric circles of markets, forest, cultivation, and pasture) to the petropolis (i.e., the modern city that depends on fossil fuel inputs) to eventually the ecopolis (i.e., a city based on the four laws of ecology, namely 1) everything is connected to everything else; 2) everything must go somewhere; 3) nature knows best; and 4) nothing comes from nothing) [112]. The idea of ecopolis is adapted from the work by Barry Commoner (1971) [113]. In this sense, the Chinese concept of "ecological civilization" is most welcome. President Xi of China famously said: "Promoting eco-civilization is an important part of China's overall plan to develop its economy, politics, culture, social progress and ecology. It is also the internal need of China's modernization construction. The people's well-being also relies on a beautiful environment. The concept of green development should be embedded in every step of social construction." [114, 115].

[31] Herbert Girardet speaks of two types of cities: 1) a regenerative city, which is powered, heated, cooled, and driven by renewable energy, and which restores degraded ecosystems; and 2) a resource-wasting city, which emits large amounts of CO_2 without ensuring re-absorption, uses resources without concern for their origins or destination of their wastes, and consumes large amounts of meat produced mainly with imported feed. Moreover, cities tend to be centers of cultural excellence, places where ideas are shared, and where people's talents are magnified by stimulating interaction and innovation [119].

[32] See for instance the Green Paper of 3 May 2006 on European transparency initiative, COM (2006) 194 final, Official Journal C 151 of 29 June 2006.

[33] The Thünen's model of agricultural land, named after Johann Heinrich von Thünen, is the first serious treatment of spatial economics and economic geography, connecting it with the theory of rent. The model made the following assumptions: The city is located centrally within an "isolated State", the isolated State is surrounded by wilderness; the land is completely flat and has no rivers or mountains; soil quality and climate are consistent; farmers in the isolated State transport their own goods to market via oxcart, across land, directly to the central city. There are no roads; and finally farmers behave rationally to maximize profits [120].

following graphic representation of concentric circles to describe citizens' priorities when it comes to their empowerment in trade, energy transition, and climate action.

Fig. 1 explains that, in the priorities of empowering citizens, trade comes first because it is a daily need with the widest and most tangible impact, unlike access to energy (which is desirable, but not essential for survival) or being a victim of the consequences of climate change (which is the least tangible and most abstract of the three concepts). Let us now, in turn, deal with each one of the three concepts in the context of empowering citizens.

3.2.1 International Trade

In December 2017, the EU Commission announced the creation of a new advisory group on EU trade agreements [121]. The aim of the group is to increase transparency and inclusiveness in EU trade policy. The EU Commission is committed to this cause [122, 123]. The perspective of this wide group of stakeholders [124] (consumer groups, trade unions, and other non-governmental organizations) on EU trade policy will certainly help towards better trade policymaking in the future. The EU Commission has also acknowledged elsewhere EU citizens' expectation that EU trade agreements should support sustainable-development objectives such as climate action [125].

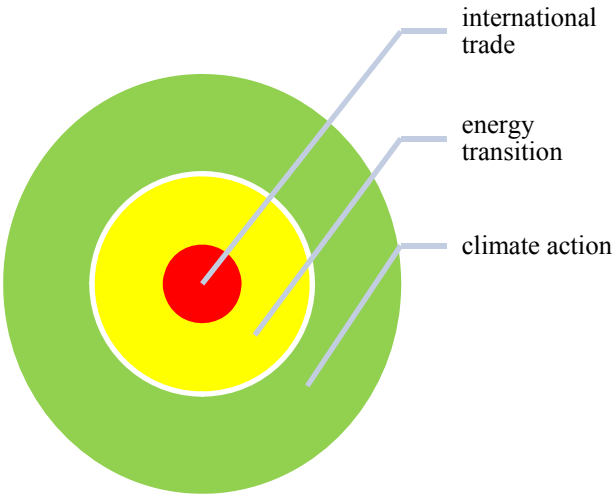

Fig. 1 Conceptualizing the empowerment of citizens in trade, energy and climate

The role of citizens and micro, small and medium-sized enterprises (MSMEs) in international trade governance is another example of a bottom-up approach to sustainable development governance that would shift the current paradigm. A report authored by the WTO Secretariat states how the current trade governance system can support MSMEs in their participation in the international trading system:

1) By helping them meet sustainability standards and conforming with other international regulations to take advantage of the opportunities resulting from global supply chains;
2) By ensuring that MSMEs can trade their goods and services in a timely and competitive manner, which will result in greater consumer confidence; and
3) By making sure that trade finance is available. Doing so will contribute to gender equality (which is the solution to achieving many of the SDGs, not the challenge), increasing economic growth, fostering innovation, and increasing participation in international trade [126].

Trading is not possible without trust. Trust is based on incentives. Citizens need to have the necessary framework that enables them the required trust to believe in a trading system where they can be participants. For instance, green consumer behavior in trade (such as gradually getting rid of using fossil fuels) will help towards the mitigation of climate change. The more harmonized the market, greater economic incentives will derive from it. A key ingredient to improving trade (in energy) is better and more efficient connection between markets. All of this can be achieved if markets work towards "zero tariffs, zero non-tariff barriers and zero subsidies" [127].

3.2.2 Energy Transition: The Role of Citizens

(1) Overview

The energy transition, which is happening at a slow

pace,[34] is an opportunity to protect the planet, as is also to create jobs and provide economic growth [128].[35] Currently, we have central generation of energy, one-way flow of energy, and passive consumers. With the energy transition, we could have distributed generation of energy and a two-way power flow.[36] The long-term goal in the energy field is 100% energy use from wind, solar, and hydropower.

The EU has called for a paradigm shift in the energy area, encouraging a shift towards a more prosumer-oriented market, placing citizens at the heart of energy security by promoting self-consumption and smaller local energy communities, where prosumers can produce their own energy. The idea is to give more control to consumers. It is believed that smart grids have enormous potential to make this happen. To enable the successful implementation of smart grids, states must have a framework in place that will enable that transition to happen. To successfully implement smart grids, states must take action to ensure the democratization, decarbonization, digitalization, and decentralization of the economy and the energy market.

Since the energy sector and the economy go hand in hand, the future of the energy transition and the future of countries' economies will inevitable go hand in hand. There are several factors to take into account in the energy transition: circularity/cradle-to-grave principle (recycling over and over again) [129], consumer's engagement, decarbonization, long-term thinking, minimizing social impact on consumers, multilevel governance (at local, regional, national, supranational, international level), simplicity, speed (namely making sure that the energy transition happens within a reasonable timeframe), affordability, and transparency with data.

But what are the main drivers of the energy transition in the energy market? Several factors seem to come to mind: access to information, communication, energy decentralization which, as a result, brings energy democratization[37] via a multilevel governance system, citizens' empowerment [130] aiming at a state of autarky (in as much as this is possible) in a customer-centered system that enables them to exploit market opportunities, new business models, innovation, stronger and smarter grids, better and smarter regulation aiming at reducing or eliminating technical barriers [131], and electrification because it drives the deployment of renewable energy [132][38].

What is the role of the market in securing a successful energy transition? It is, among other things, to set price signals, to provide regulatory adjustments to new situations, to influence the drivers that will make the energy transition a reality, to provide a level playing field, to act as an enabler for business models, to drive competition, to provide further economic liberalization, to drive consumer behavior (and vice versa, i.e., consumer behavior will drive the market), and to enable innovation.

The implementation of the energy transition will inevitably vary from country to country, based on access to technology and economic conditions [133-135] [39]. It will require the convergence of centralized with decentralized energy systems. For instance, in the case of the EU, it will require solar and wind energy integration for the implementation of the energy transition. Greater flexibility will be necessary for cross-border energy trade and for local/regional smart grids.

The energy mix is changing to low carbon and is getting cheaper. Moreover, in addition to the power sector, heating, cooling, and transport are sectors where fossil fuels need to be gradually replaced with

[34] This fact is largely due to the fact that the financial returns from oil are higher than those from renewables.

[35] On this point, see Ref. [128].

[36] This situation raises the question of how to price power produced at home.

[37] By energy democratization, we mean a situation where regions and consumers gradually become more self-sufficient in their access to energy.

[38] On renewable energy in the context of energy transition, see Ref. [132].

[39] Think for instance of the polymer problem, where having proper waste-management systems makes a difference to solve it, see Refs. [133-135].

renewables. Sector coupling (i.e., interconnecting the energy-consuming sectors with the power-producing sector) may be a way to make this possible within the energy sector and between the energy sector and other sectors.[40] In addition, reducing energy demand may not be an option in the future, given our life style in the West, which is increasingly replicated in the rest of the world. Instead, what is needed is a smart policy design for energy demand, which needs to be complemented with technological and institutional improvements on the supply side. If we succeed at a more efficient and sustainable energy system, energy imports and energy dependency will gradually fall, costs will be cut and GHG emissions reduced. One can also provide incentives for CO_2 emissions reduction [136].[41]

How can we get there? By empowering citizens in access to energy [137]. Gordon Walker has identified four types of community-owned means of renewable-energy production in the UK: 1) cooperatives, 2) community charities, 3) development trusts, and 4) renewable-energy projects with shares owned by a local community organization [138]. In addition, there are examples of cooperative models for wind turbine companies in several EU countries (namely Austria, Germany, Denmark, The Netherlands), which are illustrations of innovative models of citizens' participation and community involvement in energy production [139]. What citizens want from the grid is security of supply, lower bills, protecting the environment, and smartness.

(2) The Case of the United Kingdom[42]

a) Electricity Market

- Regulatory framework

The legal framework governing the electricity markets in England, Scotland and Wales arises from a string of regulations including the Electricity Act 1989 (as amended and supplemented); the Utilities Act 2000; the Energy Acts 2004, 2008, 2010, 2011, 2013 and 2016; the Climate Change Act 2008; the Competition Act 1998; the Enterprise and Regulatory Reform Act 2013; and the Infrastructure Act 2015. As to Northern Ireland, key legislation in respect of the regulatory architecture of its electricity sector includes the Electricity (Northern Ireland) Order 1992; the Energy (Northern Ireland) Order 2003; and the Electricity (Single Wholesale Market) (Northern Ireland) Order 2007. At the EU level, the European Commission has ushered changes since the 1990s through a series of Directives and Regulations (Legislative Packages) that have strongly influenced the current state of affairs of the electricity market in the UK [140].

The electricity market in the UK is geographically divided into two separate networks. On the one hand, England, Scotland and Wales form the Great Britain (GB) system. On the other hand, Northern Ireland and the Republic of Ireland constitute the Single Electricity Market (SEM). This latter arrangement poses arresting questions in light of Brexit. The SEM represents a rare example of network integration between the UK and another EU Member State. Indeed, Northern Ireland lies outside the GB system whilst being effectively attached to the Republic of Ireland in a single electricity system [141].

The Gas and Electricity Markets Authority (GEMA) was established as the regulatory authority for electricity and gas markets in the UK by the Utilities Act 2000. Its prerogatives are delineated in an array of statutes: the Electricity Act 1989; the Competition Act 1998; the Utilities Act 2000; the Enterprise Act 2002;

[40] See for instance European Commission, Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee, the Committee of the Regions and the European Investment Bank, "Clean energy for all Europeans", COM (2016) 860 final, 30 November 2016, available online at: http://eur-lex.europa.eu/resource.html?uri=cellar:fa6ea15b-b7b0-11e6-9e3c-01aa75ed71a1.0001.02/DOC_1&format=PDF; European Commission, "A Roadmap for moving to a competitive low carbon economy in 2050", COM (2011) 112 final, 8 March 2011. These two policy papers aim at the convergence of liberalization with climate action.

[41] California is considering the possibility of subsidies to remove CO_2 [136].

[42] This section has been authored by Juan A. Rios.

and the Energy Acts 2004, 2008, 2010, 2011 and 2013 [142]. The Electricity Act 1989 (as amended and supplemented) sets out a licensing regime to be regulated by the GEMA which operates through the Ofgem. A licence is mandatory for the following specified activities: generation; participation in transmission; distribution; supply; participation in the operation of an electricity interconnector; and the provision of smart metering services.[43] Applicants need to submit a written application and pay the relevant fee to the Ofgem. The Ofgem establishes the conditions of the licence. Certain actors such as small-scale generators, distributors and suppliers may be exempted from holding a licence insofar as they meet particular requirements.[44] Licences are subject to different types of conditions: standard conditions (generally applicable to all licensees); amended standard conditions; and special conditions (specific to the licensee at issue). In addition to these requirements, licensees must observe their specific industry codes, which are usually outlined in the standard conditions of their individual licence [143].

Pursuant to the Electricity Act 1989, the construction or extension of an onshore generation facility (with the exception of wind generation facilities) located in England and Wales with a capacity exceeding 50 MW requires the consent from the Secretary of State for Business, Energy and Industrial Strategy.[45] These type of facilities are usually classified as "Nationally Significant Infrastructure Projects" (NSIP) under the Planning Act 2008.[46] NSIPs need to be sanctioned by the Secretary of State for Business, Energy and Industrial Strategy through a development consent order. As to the construction of onshore facilities in England with a capacity under 50 MW, such initiatives might require approval from the relevant local planning authority in accordance with the Town and Country Planning Act 1990 [144]. In Wales, onshore generation facilities with a capacity ranging from 10 to 50 MW are treated as "Developments of National Significance" (DNS) and are decided by Welsh Ministers.[47] The Energy Act 2016, coupled with the Infrastructure Planning (Onshore Wind Generating Stations) Order 2016, withdrew onshore wind farms featuring a capacity surpassing 50 MW from the NSIP regime. Furthermore, these regulations allocated the authority to grant planning permissions for this type of generation facilities to local planning authorities. Local planning authorities already enjoy the prerogative to grant such permissions to onshore wind farms with a capacity of 50 MW or less [145].

The GB system transmits high-voltage electricity through a transmission grid that stretches across Great Britain. The GB system is owned and maintained by a number of Transmission System Operators (TSOs) while the system is chiefly operated by a single System Operator (SO): National Grid Electricity Transmission plc (NGET). There are three TSOs entitled to develop, operate and maintain the high-voltage network within their corresponding onshore transmission areas: NGET for England and Wales; Scottish Power Transmission Limited for Southern Scotland; and Scottish Hydro Electric Transmission plc for Northern Scotland and the Scottish island groups [146]. In England and Wales, generation facilities with a capacity equal or superior to 100 MW may be connected to the transmission system. Smaller plants are directly connected to the lower voltage distribution network. In Scotland, however, smaller generation facilities may be directly connected to the transmission grid [147].

The SEM in the island of Ireland is the homologue of the GB system in Great Britain. The SEM also features a Single Electricity Market Operator (SEMO) which facilitates the continuous administration and operation of the grid. The SEMO is a joint undertaking from the two official TSOs of the island

[43] Section 6, paragraph (1) Electricity Act 1989.
[44] Section 5 Electricity Act 1989.
[45] Section 36 Electricity Act 1989.
[46] Section 14, paragraph 1 Planning Act 2008.
[47] Section 19 Planning (Wales) Act 2015.

of Ireland: System Operator for Northern Ireland Ltd (SONI) in Northern Ireland; and EirGrid plc in the Republic of Ireland. The SEMO is cooperatively licensed and regulated by the Utility Regulator for Northern Ireland (UREG); and the Commission for Regulation of Utilities (CRU) in the Republic of Ireland [148].

Industry codes support the wholesale and retail markets for electricity and gas. Licensees are bound by these codes in accordance with the terms of their licence [149]. The GB system [150] and the SEM [151] have their separate industry codes.

The Energy Act 2013 instigated the Electricity Market Reform (EMR). The EMR was characterised by two notable developments in the wholesale electricity market. Firstly, it introduced contracts for difference (CfD) to promote low-carbon electricity generation. CfDs are a mechanism designed to encourage investment in electricity from Renewable Energy Sources (RES-E). CfDs are long-term, private law, bilateral contracts between a generator and a Low Carbon Contracts Company (LCCC) [152]. Under a CfD, the generator is paid the difference between the "strike price" — a price for electricity reflecting the cost of investing in a specific clean technology — and the "reference price" — the average price for electricity in the market — by the LCCC. Therefore, CfDs safeguard electricity generators from price volatility in wholesale markets [147]. This system is funded through a fee on electricity suppliers. Should the reference price be above the strike price, then it is the generator that offsets the difference to the LCCC. Such payments are eventually returned to electricity suppliers [152].

Secondly, the EMR introduced the capacity market. This policy seeks to ensure the continuous supply of electricity. The capacity market offers remuneration to those generators that are able to generate power during intervals of system stress. The mechanism also rewards demand side response providers for lowering demand at times of peak demand [152]. The Electricity Capacity Regulations 2014 and the Capacity Market Rules articulate the basic legal framework of the capacity market [147].

In addition to CfDs, the UK has mobilised supplementary policies to spur electricity generation arising from alternative energy sources, such as RES or combined heat and power (CHP). One such example is the Feed-In Tariff (FIT) scheme. The FIT scheme was established in April 2010. This governmental programme was implemented to forward small-scale renewable and low-carbon electricity generation technologies. Licensed power suppliers participating in the FIT scheme are required to make payments on generation and export from eligible installations. The following types of technologies are eligible under this programme: solar photovoltaic (PV), wind, hydro and anaerobic digestion (for installations with a capacity not exceeding 5 MW); and micro CHP (for installations with a capacity not exceeding 2 kW). Payments under the FIT scheme are made on a quarterly basis for the electricity generated and exported by installations that resort to one of the aforementioned technologies. These payments are incurred by energy suppliers based upon the meter reading submitted by the owner of such an installation [153]. Solar PV is the technology of choice in terms of low-carbon electricity generation in the UK as it enjoys the strongest public support. Solar PV, together with onshore wind, is expected to become the most affordable means of electricity generation by 2025. As of 2017, over 12 GW of solar PVs were deployed in the UK. Small production facilities (under 4 kW) installed in households and small businesses accounted for 2.5 GW of this overall solar PV capacity. Solar PV is expected to become an increasingly significant contributor to the domestic electricity supply. Moreover, a sizeable fraction of this solar capacity will be highly diffused [154].

Generally speaking, the domestic regulatory architecture in the aftermath of Brexit will

conceivably be framed by the terms of the UK's withdrawal from the EU. A Repeal Bill was announced in June 2017. This bill shall repeal the European Communities Act 1972, thus ending the ascendancy of EU law in the UK. The British government will convert the EU "*acquis*" (the body of rights and obligations arising from EU law binding on EU Member States) into UK law. Thereafter, the discretion to amend this law will lie with the Parliament after due parliamentary debate and scrutiny. As to electricity market itself, the question as to whether the UK will retain access to the Internal Energy Market (IEM) seems largely contingent upon it remaining a member of the European Economic Area (EEA). Should the UK remain in the EEA, it would preserve access to the IEM whilst having to comply with EU acts with EEA relevance [155]. Conversely, should the terms of the Brexit deal preclude entry to the IEM, this will possibly distort the UK's electricity trade and increase operator and consumer costs [147].

- Energy security dimension

The GB system has an overall interconnection capacity of 4 GW. The GB system shares cross-border electricity infrastructures with North-West Europe and the SEM. More concretely, interconnectors with North-West Europe represent 3 GW of its overall transfer capacity (2 GW with France through "IFA"; and 1 GW with the Netherlands through "BritNed"), whereas interconnectors with the SEM account for the remaining 1 GW (500 MW with Northern Ireland through "Moyle"; and another 500 MW with the Republic of Ireland through "East West"). Ofgem expects a further 7.7 GW interconnection capacity to be achieved by 2022. To that end, the manufacture of new cross-border links with Belgium ("NEMO"), Denmark ("Viking"), France ("ElecLink", "IFA2" and "FAB Link"), Norway ("NSN"), and the Republic of Ireland ("Greenlink") is high on the agenda [156]. If all of the above projects do materialise by 2022, the interconnection level of the UK is set to treble in a remarkably short time span.

NGET foresees that the importance of interconnection with neighbouring countries towards grid balancing will rise as intermittent RES are poised to progressively underlie future demand [157]. In light of the closure of ageing nuclear plants in the UK and the governmental decision to refrain from using coal power by 2025, increased access to power generation from abroad could counterbalance the waning output of these different domestic sources of electricity. Indeed, BEIS predicts that electricity imports have the potential to become the second largest source of electricity by 2025 [158].

Electricity is usually transmitted from the market with lower prices to the market with higher prices. Considering that the price of wholesale electricity in Great Britain tends to be higher than in France and the Netherlands, the GB system normally imports electricity from these two EU Member States. In contrast, exports and imports between the GB system and the SEM are more equally balanced. Price disparity between wholesale markets is motivated by divergence in a number of respects such as electricity generation mix; weather trends; energy and climate change policies; demand patterns, and exchange rates. Having said this, interconnection between wholesale markets leads prices to converge (that is, prices in the importing market dwindle whereas prices in the exporting market rise). Hence, wholesale electricity prices in Great Britain have experienced a reduction as a result of the GB system being a net importer [147]. There is a consensus among stakeholders that, due to the prevailing higher wholesale electricity prices in Great Britain, more interconnectors will entail a further downturn in prices. In 2014, NGET estimated that every additional 1 GW of transfer capacity between the GB system and continental Europe could lower wholesale prices in Great Britain by 1 to 2% [159]. Nevertheless, the existence of constraints regarding the extent to which savings can be achieved

must be borne in mind. Indeed, price reductions become less pronounced with each new interconnector to the same market [160].

b) Smart Metering Systems

The Smart Meter Implementation Programme (SMIP) sets out the legal framework to install smart meters, both for gas and electricity, in every household in Great Britain by 2020. It is expected that, by that year, approximately 53 million smart meters will be fitted in more than 30 million properties (whether households or businesses) scattered across England, Scotland and Wales. According to Smart Energy GB, the SMIP represents "the biggest national infrastructure project in our lifetimes". Nonetheless, there is no legal obligation on individuals to have a smart meter. After several delays, the SMIP was officially launched in November 2016. At the time of writing, over 8.6 million smart meters have been deployed [161].

Smart meters in the UK present the peculiarity of always including an in-home display (IHD). An IHD is an implement which is connected with the smart meter and shows consumers the information pertaining to their energy consumption and costs [162]. The UK constitutes a rare instance of a jurisdiction that intrinsically combines smart meters with IHD. Indeed, energy suppliers in the UK make it a requirement for customers that opt to have a smart meter installed to also use an IHD, together with a data hub. A further distinguishing characteristic of the UK is that it pushes both separate electricity and gas smart meters [163].

As opposed to other EU Member States which rely on Distribution System Operators (DSOs) to carry out the deployment of smart metering systems, the UK has decided to entrust this task to energy suppliers. The competition inherent in the market of energy providers inevitably raises the installation costs as households in a same street may well obtain their energy from different suppliers. This fragmentation precludes a systematic implementation of the smart meter roll-out, in a street-by-street basis. The DCC is the entity charged with the control of the smart metering communication system. Additionally, the DCC will form contractual relationships with energy providers [164]. Notwithstanding the fact that Smart GB is the "voice" of the deployment of smart meters, a wide variety of actors has been crucial in the promotion of smart metering systems over the last decade. BEIS, Ofgem, as well as the energy suppliers SSE and British Gas rank among the most enthusiastic supporters of this "smart" transition [165].

The SMIP epitomizes a clear cut case in which policy outdistances technological developments. This is so as over-optimistic goals have had to be toned-down, time and time again, as a consequence of the piling backlog of technical obstacles encountered on the way [165]. Market research demonstrates that installation failures continue to be a usual occurrence. A survey conducted by "Utility Week" in 2017 established that up to 13% of households required multiple visits to fit their smart metering system properly. Reasons for such mishaps include customers being absent during the installation; installations taking longer than expected; smart meters being inaccessible or a substantial distance apart; and the challenges confronted in multiple occupancy properties [166]. Other studies suggest that the predictions from BEIS have underestimated this reality. According to the research directed by "the Big Deal", these glitches alone are liable to balloon the costs of the SMIP by an extra £1 billion. Consequently, the total costs of the SMIP would soar to £12 billion [167].

The Smart Meters Bill was introduced in Parliament in October 2017. Broadly speaking, the Smart Meters Bill has a twofold purpose. Firstly, the bill seeks to prolong by 5 years the government's prerogative to make changes to smart meter regulation (until 1 November 2023). The government strives to thereby ensure that the deployment of smart metering systems is successfully completed by 2020; that all benefits are

thoroughly reaped; and that consumers are suitably protected in the wake of the roll-out. Secondly, the bill undertakes to establish a special administration regime for a smart meter communication licensee. This special administration regime for the DCC constitutes a contingency measure aimed at guaranteeing the continuity of smart meter services in the improbable event of the DCC's insolvency. While the likelihood of this turn of events is rather remote, it would bring about significant consequences for consumers [168].

c) Data Protection

The Data Protection Act 1998 articulates the basic legal framework in the UK for this particular area. In spite of the UK's decision to withdraw from the EU, Regulation (EU) 679/2016, also known as General Data Protection Regulation (GDPR), will still be applicable to the UK as of May 2018. At the time of writing, the Data Protection Bill — which will transpose the GDPR into domestic law — has already been introduced in Parliament [169].

The national data protection authority is the Information Commissioner's Officer (ICO). The ICO has the task to safeguard and enforce a number of regulations including the Data Protection Act 1998; The Freedom of Information Act 2000; the Privacy and Electronic Communications Regulations 2003; and the Environmental Information Regulations 2004. The ICO is an independent body from the government that protects information rights in the public interest. It does so by advancing transparency in public entities and data privacy for citizens. The ICO provides guidance to both citizens and organisations. It takes adequate measures when the regulations set out above are breached [170].

Consumption data arising from a private household in relation to a period of less than a month is treated as personal data. Accordingly, the access of Distribution Network Operators (DNOs) to information of this nature is subjected to the compliance with the applicable pieces of legislation. More concretely, access to this household-level electricity data must observe the prescriptions laid out by the Data Protection Act 1998 — in respect of treatment of personal data — as well the Privacy and Electronic Communications Regulations 2003 — with regard to the privacy of consumers using communication network or services. Further, the electricity distribution license delineates in its Condition 10A (SLC10A) the terms and requirements under which DNOs can access consumption information provided by smart metering systems. DNOs submit "data privacy plans" to the national regulator — Ofgem. In these "data privacy plans", the network operators clarify the manner in which the consumption data will be anonymised, to ensure that the processed data cannot be used to identify a particular household [171].

The Data Access Privacy Framework (DAPF) regulates the use of customer's energy consumption data stemming from smart meters. These guidelines, drafted by Ofgem, assign certain responsibilities to energy providers and DNOs on the subject of their access to consumption data. The precise granularity of the data that can be accessed will be ascertained by whether the consumers have decided to opt in or opt out. At any rate, the DAPF issues the following basic instructions:

- By default, energy suppliers can access monthly consumption data in the interest of billing and accounting.
- Unless the customer decides to opt out, energy suppliers can access daily consumption data.
- If the customer decided to opt in, energy suppliers can access less granular data, down to half-hourly data [172].

Generally, DNOs are prevented from accessing half-hourly consumption information unless the latter has been anonymised or aggregated in such a fashion that it can no longer be considered as personal data. Be that as it may, any use of consumption information by energy providers and DNOs needs to subscribe to the principles charted by the DAPF [173].

d) Electric Vehicles

Pursuant to the Climate Change Act 2008, the UK has set itself the objective to cut greenhouse gas emissions by 80% by 2050. The necessity to adopt EVs in order to meet this target is widely agreed on among policymakers [173]. To that end, the government *inter alia* created the Office for Low Emissions Vehicles (OLEV) and mandated the discontinuation of fossil fuel vehicles in the UK from 2040 onwards [174].

EVs feature prominently in the Industrial Strategy drafted by BEIS. This scheme provides a £30 million fund to promote vehicles-to-grid (V2G) technologies. These efforts are intended to pave the way for EVs and other vehicles to export electricity to the grid. Twenty-one V2G projects have become the recipients of this subsidy. This raft of initiatives aims to deliver an appropriate design and development model to illustrate how the electricity system at large could, at peak hours, benefit from the power stored in EVs. At first, the electricity stored in EV batteries could serve the domestic grid during peak hours. Thereafter, the same batteries would be recharged, during off-peak hours, thereby enabling EV drivers to set off on their next journey [147].

The Automated and Electric Vehicles Bill was announced in October 2017. This anticipated legislative initiative contains a number of points that are worth raising. Firstly, the bill will increase the access and availability of EV charging points. More specifically, the document calls for charging points at all motorway services as well as large petrol stations. Secondly, the Automated and Electric Vehicles Bill further ventures into the field of automated vehicles. After all, the market for driverless technology is estimated to be worth £50 billion to the national economy by 2035. The bill seeks to enable drivers of automated cars to be insured on UK roads [175].

e) Demand Response

The Energy Act 2013 and the consequential EMR established the capacity market. The capacity market is a policy that seeks to guarantee the uninterrupted supply of electricity. Generators that are capable of producing electricity during intervals of system stress are rewarded through this scheme. By the same token, the capacity market remunerates demand side response providers for lowering demand at times of peak demand [176]. The Electricity Capacity Regulations 2014 and the Capacity Market Rules determine the content of capacity agreements; the obligations of (and possible penalties against) the holder of a capacity agreement; and the technical operation of the capacity market [177].

f) Electricity Storage

There is no regulatory definition for the concept of energy storage under the Electricity Act 1989. This legal vacuum has resulted in energy storage being treated as a generation asset. This categorisation is further reinforced by Section 2, paragraph 2, point (d) (i) Electricity Order 2001 which confirms that the operator of "equipment" which "generates or is capable of generating electricity" will be regarded as generating electricity. The current state of affairs poses difficulties as it fails to recognise that energy storage is unable to produce a net positive flow of electricity into the system; or the possibilities that storage opens by saving electricity during intervals of low demand to meet peak demands [178].

In light of the above, energy storage operators currently need to hold a generation license to operate unless an exemption applies (e.g., "small generator" exemption). Additionally, other licensed operators such as energy suppliers, DSOs and Transmission System Operators (TSOs) are restricted from operating electricity storage. A generation license places a twofold administrative burden on the energy storage operator. Firstly, the latter becomes answerable to the Ofgem. Secondly, the energy storage operator is liable to be subjected to a number of industry codes.

Under the prevailing legal framework, the energy storage operator also faces the risk of having to pay

special rates. The Climate Change Levy (General) Regulations 2001 establishes a toll on supplies of "taxable commodities" — which include the supply of electricity to an industrial or commercial user. In this context, the energy storage operator may end up paying double charges. This is so as the energy storage operator is legally classified as both an electricity consumer and generator. At first, he is assimilated to a consumer when paying the CCL rates for the energy that he "receives" (when charging). Subsequently, he is treated as a generator when paying the CCL levy for the energy that he "supplies" (when discharging) power to industrial or commercial users. The present regulatory barriers are effectively hampering the market development of storage technologies in the UK [179].

3.2.3 Climate Action

An influential climate-change thinker, William Nordhaus, recommended in the 1990s gradual, modest reductions of GHG emissions in his book on the economics of climate change [180]. Another thinker of climate change, Nicholas Stern, demanded a few years later immediate and dramatic efforts to mitigate climate change, including spending 1-2% of GDP in advanced economies [181]. For both approaches, it is necessary to have cooperation from the bottom up [182, 183].[48] This is possible without compromising on economic growth [184].[49]

Predictions are that there will be a 7-degree rise in global temperatures by 2100, which would make life very difficult in various part of the world, especially those near the Equator [185]. So international cooperation is crucial for climate change mitigation. A promising way forward is bringing together environmental NGOs and businesses for greater and close cooperation on issues of climate action [186, 187]. A case in point that became a surprising fact is the very well organized social movement in the US to implement the Paris Climate Agreement as soon as President Trump announced his intention to withdraw from that Agreement. Cities, states and businesses gathered together for climate action. Outside the main conference building of the 2017 UN climate summit, a coalition of people gathered under the heading "We are still in" [188]. Many cities in the US today are requiring tougher energy-efficient standards on buildings and electrifying their public buses, as signs of commitment to the Paris Agreement [189]. Since cement-making produces around 6% of the world's CO_2 emissions and steel around 8% (half of it goes into buildings), the most logical building material to use would be wood because it is renewable energy in that a mature tree is cut down, but a new tree can be planted and it will capture CO_2 [190]. A further incentive for using wood for construction purposes is that it is much lighter than steel, brick or concrete. From January 2019, all new public-sector buildings in the EU need to be built to nearly zero-energy standards [190].

Equally, joint actions between countries could have a "trickle-down effect" from governments to citizens and businesses for the promotion of business opportunities in clean energy, especially for small and medium enterprises (SMEs), the facilitation of trade and investment in environmentally friendly goods and services such as energy efficient goods and services, and cooperation on trade-related aspects of climate change mitigation [191, 192].

3.2.4 Power to the Citizens

One very promising development in the twenty-first century is the empowerment of citizens on issues of common concern such as climate change, sustainable energy, and international trade. Citizens' empowerment means that civil society can play an important role in the new challenges of trade diplomacy, such as the integration of noneconomic aspects of trade in trade policy and the inclusion of

[48] The issue of climate change mitigation has even reached democratic levels as close to citizens as teenagers suing the US federal government as part of efforts to force action to request climate action [186, 187].

[49] Which makes a moral case for economic growth and is a source of inspiration and optimism about our future possibilities.

trade policies in the democratic debate [193-195].[50] This approach makes the system of decision making closer to the citizens and therefore less technocratic (see Fig. 2).

This novel idea of greater citizen participation, engendered by citizens' empowerment, is a promising way of providing better management of environmental issues and helping achieve the Sustainable Development Goals (SDGs) [196]. Moving forward, citizens must contribute to finding more effective ways to obtain sustainable energy, mitigate climate change, and develop a more democratic and transparent trade policy-making process. Fig. 2 represents several specific means by which citizens can ostensibly help enhance sustainable energy initiatives, mitigate climate change, and make citizens richer through free and open environmental trade.

Citizens' empowerment can be achieved by allowing for more participation in the process of decision making. More broadly, regression analyses show that when society allows free choice, it has a considerable impact on happiness [197].[51] Since the beginning of the 1980s, democratization, economic development, and increasing social tolerance have all increased

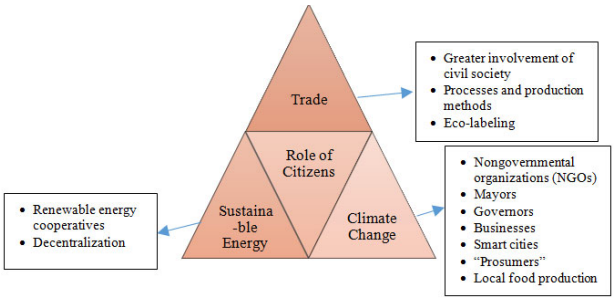

Fig. 2 Citizens' empowerment and sustainable development goals.

citizens' perception that they have free choice, and consequently increased citizen happiness [198].

3.2.5 Citizens and Trade (and Climate Change)

Traditionally, governments discuss trade measures and their links with climate change without allowing for citizens' participation [199]. This rather technocratic exercise of mitigating climate change and its links to trade policy has the potential to become more democratic.

Trade will need to be substantially reconceptualized to empower individuals within the international trade framework. If global society wants to emancipate people around the world and benefit from the wealth of transnational insights, perceptions, and resources, society should aim at facilitating access to global knowledge via international trade. Moreover, trade agreements should emphasize and encourage the trade of technological equipment, smart appliances, and applications that serve to reduce energy consumption and GHG emissions. Furthermore, trade subsidization distorts markets and leads to more GHG emissions than would otherwise result [200].[52]

Trade places a spotlight on the dynamic shifts that are taking place and will take place globally in the so-called processes and production methods (PPMs) of goods. Consumers increasingly seek information on how the PPMs of the products they buy affect the environment and request eco-labeling as well as labeling and traceability regarding genetically modified organisms [201]. This change in consumer demand will transform the geographies of trade, both spatially and temporally. The importance of new technologies in PPMs is a crucial aspect of this advancement.

International trade agreements could have provisions that empower citizens as consumers to better scrutinize trade agreements. This addition would

[50] For analyses of democracy, see Ref. [197], asserting that an increasingly oppressive liberal world order will likely give way to authoritarian illiberalism; exploring how Donald Trump was elected and asserting that his governance has harmed American democracy [198]; examining historical threats to democracies and drawing lessons from other nations to offer strategies to follow in the current American context [199].

[51] One wonders whether lack of freedom, high levels of pollution or social inequality may explain why, say, China ranked so poorly in the 2018 World Happiness Report [202].

[52] One could make the case that some World Trade Organization (WTO) rules need clarification, especially in the field of subsidies, and ask the question whether trade subsidies should exist if they are for a good purpose, such as a public good like climate change mitigation.

make trade governance closer to citizens. Close scrutiny is necessary to examine the rules of international trade that need to be amended to reduce the impact of global trade on the environment [202]. In broad terms, trade rules are not guided towards environmental protection as much as they could be.[53]

The ease of proliferation of news and information through the Internet — which provides more transparency and access to information than ever before — has allowed people to become more aware of trade negotiations and their effects. This increased awareness has resulted in demonstrations against what many citizens consider unfair and detrimental trade agreements that are supposed to benefit ordinary citizens but in reality only benefit a few [203]. Classic examples are the massive demonstrations against the Trans-Pacific Partnership (TPP) in the United States [204] and against the Trans-Atlantic Trade and Investment Partnership (TTIP) in Germany, Austria, and Sweden [205]. These demonstrations occur because citizens widely consider trade to be designed by and for the interest of large transnational corporations, rather than for the needs of the general population [206][54]. So, reshuffling political procedures by drawing citizens into these processes is necessary, and arguably indispensable. It is, therefore, worth exploring how local and regional governments[55], such as those of cities or municipalities represented by their mayors, can better represent the interests of their people.

Accountability, efficiency (via more rapid feedback), and transparency are strongest at the governing level closest to citizens. In a post-Westphalian world, neomedievalism [207][56] may prevail, but the role of the city can be preponderant. The involvement of citizens can be encouraged in different intellectual and cultural ways, such as within civil society's role in liberal Western democracies, within the Asian values [208] [57] context in China [209] [58], or citizens' empowerment in theocracies. Politically, the principles of subsidiarity, devolution, federal systems, regional schemes, and closer ties between specific cities — not least within the European Union — form the background for a rising role for the cities of the world to come together. All these innovative options of governance make decision-making easier and more impactful and aim at a decentralized system of governance.

Lastly, given that citizens' roles in trade are primarily as consumers, for their activities to have an impact on climate change mitigation efforts, consumer activity (i.e., purchases) must be significantly valued within the broader economic dynamic of a country. Table 2 assesses the consumer habits in eight major GHG-emitting states that are also parties to three mega-regional trade agreements (RTAs) (the CPTPP, TTIP, and the Regional Comprehensive Economic Partnership (RCEP)) to ascertain whether consumer spending is of significant importance such that a change in consumer habits could influence trade patterns in these jurisdictions. Table 2 indicates consumer spending as a percentage of gross domestic

[53] See for instance the Preamble to the Agreement Establishing the World Trade Organization, which states:

> *Recognizing* that their relations in the field of trade and economic endeavour should be conducted with a view to raising standards of living, ensuring full employment and a large and steadily growing volume of real income and effective demand, and expanding the production of and trade in goods and services, while allowing for the optimal use of the world's resources in accordance with the objective of *sustainable development*, seeking both to protect and preserve the environment and to enhance the means for doing so in a manner consistent with their respective needs and concerns at different levels of economic development . . . . (emphasis added)

Marrakesh Agreement Establishing the World Trade Organization, Apr. 15, 1994, 1867 U.N.T.S. 154 (1994).

[54] For an example of this perspective, see Ref. [210].

[55] Local governments today are bearing the costs of climate-change disasters. Conversely, if CO_2 is removed from the air by planting trees in a given part of the world, who benefits from this GHG emission sequestration?

[56] "Neomedievalism" is a term often used as a political theory about modern international relations [207].

[57] Values are desirable, tans-situational goals, varying in importance, that serves as guiding principles in people's lives [208].

[58] The "Asian values context" refers to the notion of collectivism, rather than individualistic approaches to society that are more prevalent in Western societies [209].

Table 2 Household Final Consumption Expenditure [210].

Country/Actor	Consumer spending as percentage of GDP
China	37.1
United States	68.1
European Union	56.3
India	59.2
Russia	52.1
Indonesia	55.4
Brazil	63.8
Japan	56.6
Canada	57.5
Mexico	67.1

product (GDP). The figures are based on the market value of all goods and services, including durable products (such as cars, washing machines, and home computers), purchased by households.

Consumer spending contributes significantly to the GDPs of the countries in Table 2, with the exception of China. So, empowering citizens to be more climate change-conscious in their purchasing habits could spur the growth of "greener" markets in the jurisdictions that are parties to the three mega-RTAs mentioned above by creating high demand for greener goods.

3.2.6 Citizens, Climate Change, and Sustainable Energy (and Trade)

The empowerment of citizens is a promising tool for climate change mitigation, but it depends upon support from NGOs, mayors and governors representing citizens, smart citie[59], digitalization of data, prosumers, and local food production[60]. The same is true with the enhancement of sustainable energy via renewable energy cooperatives[61] and energy decentralization. The decentralization and localization of energy dependency could potentially lead to a change in the relationship between energy producers and governance institutions, including municipal administrations and city mayors. The Paris Agreement can be characterized as a hybrid global agreement that facilitates these changes within a multipolar world. The global stock-take (Article 14 of the Paris Agreement) will foster new ways of valuing, seeing, and comparing sectors, communities (rich and poor, urban and rural), countries, and regions. This data will inform other agreements as well as policy on resource management (such as eco-labeling and PPMs).

The opportunities ahead are partially the result of technology enabling a decentralization of production and processing of goods — for instance, 3-D printing as opposed to Fordist-style manufacturing — and a dynamic hybridization of services — for instance, the gig economy — away from old hierarchical and linear models towards multilevel and circular ones. The form these will take depends upon how the power dynamics will manifest, including backlash by citizens, corporations, and countries with the most to lose within the existing globalized trade system. This hybridization indicates a recognition that there is no inevitable, single pathway or outcome; rather, that the political economy within, and between, regional contexts will influence the potential opportunities and outcomes for citizens' engagement.

4. Conclusion, Recommendations and a Future Research Agenda

This paper sheds light on the emergence of a new actor, namely the prosumer, in the EU's energy security arena. The paper has shown that prosumers can share extra energy production with others and serve

[59] By smart city, we mean a city that is a self-sufficient unit and has digital technology embedded across all its functions to enhance performance, well-being and communication, and also to reduce costs and resource consumption.

[60] "Smart cities" refers to an urban development vision to integrate information and communication technology and Internet-of-things technology in a secure fashion to manage a city's assets [211]. "Prosumers" refers to consumers who are also producers of (renewable) energy and who use energy in a smarter and more efficient manner [212]. And "local food" refers to a movement that aims to connect food producers and food consumers in the same geographic region to develop more self-reliant and resilient food networks; improve local economies; or have an impact on the health, environment, community, or society of a particular place [213].

[61] Renewable energy at cooperative level is big enough to be technologically and economically efficient, and small enough to be locally owned or controlled. In addition, local projects can help in local economic and social regeneration. The benefits of 'localisation' have to be set against the technical and economic advantages of larger scale systems.

as a shelter for micro-grids. To reach scalability within sustainability in the case of micro/mini-grids, they would need to be subsidized.

Sustainable energy is rapidly becoming an EU special brand, like the protection of human rights, in the quest for looking after the environment. Achieving sustainable energy encompasses the following points: decarbonising the economy (by using less energy based on fossil fuels and making greater use of clean energy), democratising access to energy (namely everyone has the right to participate), digitalization, diversification of energy supply, and disrupting traditional energy cycles. Leadership is shifting from national politics to local politics and, therefore, power is being decentralised. For instance, when there is a disaster in a given neighborhood, citizens do not contact the head of State or government of the nation, but the mayor of the city. A clear example of this trend towards local politics is the Local Governments for Sustainability platform.[62] These decentralized solutions are the way forward because they enable democratization of energy throughout the world, which empowers citizens, shifting the current paradigm.

As part of the global energy transition, two factors are crucial: 1) continued global economic growth, which is a must, and 2) the protection of the environment. Therefore, it is necessary to have a strategy that is realistic, fair, and pragmatic. Realistic because the transition will take time and cannot be done overnight. Fair because energy poverty deserves attention. And pragmatic because GHG emissions must be addressed via more efficient technologies. Access to energy will depend on the link between consumers and producers. Having in place the right regulations will help speed up the process of energy transition.

Following trends in the EU towards decentralisation and the emergence of a "gig" economy, the energy sector is currently undergoing a large-scale transition. One of its core aspects is the progressive top-down diffusion of the potential, competences, and leverage from EU institutions, States, and corporate actors across the energy value chain towards prosumers, who need to be at the centre of the energy transition for it to happen democratically in a bottom-up manner. This phenomenon can be conceptualised as energy democratisation, namely moving away from a few energy companies monopolising access to energy towards energy owned mainly by consumers, making consumers of the utmost importance. Therefore, energy transition can only happen if there is citizen participation.

All of this is achievable by shifting the current paradigm to one that is more human-centric, by linking projects to people, and more collaborative in how it tackles various obstacles, whether legal or behavioural. Think of the analogy of organic food: it is more expensive, but for many, its benefits outweigh the costs. Moreover, consumers have the power to choose either organic or non-organic. By the same token, many citizens are interested in climate-friendly products even if they are more expensive. This means that we need to look at the whole production process, not just the end product, if we are serious about consumer empowerment. To get there, legislation must remove barriers to participation and protect and promote consumers to enable them to produce, store, sell, and consume their own energy.

While all of the above creates ample potential for facilitating and improving the EU's security of supply as well as fulfilling its climate targets, several caveats exist. These not only are confined within energy security prerogatives, but also extend to the critical management of digital security, which the digitalisation of energy services brings to the fore. So, for consumers to become prosumers and engage in the energy transition, it will be crucial to make the process interesting and simple and to inform them much more, given the current level of energy consumer dissatisfaction.

[62] Local Governments for Sustainability is an international association of local and metropolitan governments dedicated to sustainable development [214].

Here is where cities can play a major role at educating citizens on energy transition and climate change mitigation, not least because cities consume three quarters of the world's energy [215], and because they are smaller entities than countries or regions, so it is easier to get things done. Even more impactful would be to educate companies and policymakers on sustainable development, since there are fewer of them than there are citizens. Doing so will shift the paradigm from a system that is producer-centric to one that will be consumer-centric. With development have come environmental and social problems such as climate change, poverty, wars, unhappiness, depletion of resources, and environmental pollution that need to be rectified. This paradigm shift is crucial because development is not possible without energy and sustainable development is not possible without sustainable energy.

Society can minimize the level of suffering resulting from climate change by doing a lot of climate change mitigation and adaptation. As John Holdren says, "we need enough mitigation to avoid the unmanageable and enough adaptation to manage the unavoidable."[63] In an ever-shifting context, demand management emerges as a key issue. The provision of adequate and precise information to prosumers — so that they can optimise their use of smart grids — as well as the transition to targeted, flexible contracts to adjust to the needs of prosumers need to be embedded in well-articulated broader policy and market regulatory frameworks. Moreover, private and public finance should be effectively attracted and directed to indispensable infrastructure schemes that will enable the transition from the traditional centralized power network to the decentralized nexus of smart grids. And it is well known that, where finance flows, action happens. Currently, both centralized and decentralized energy are interdependent and help each other.

Renewable energy can supply all our energy forever at costs comparable with existing energy sources and without their major environmental and social impacts. The technologies that will be prioritised in terms of energy generation to back renewable-energy generation will play a crucial role in facilitating the role of prosumers in the new market in-the-making. Since renewable energy is becoming more competitive, more green jobs will be created in the future and the trend towards a clean energy revolution is ever closer. This energy transition into renewable energy, in turn, will help both enhance energy security and mitigate climate change. So rather than investing large amounts of money into building liquefied natural gas terminals and gas pipelines [216][64], the EU should make a greater effort to invest in renewable energy.

The emerging establishment of prosumer markets is an invaluable development that will enable the transition from supply-driven to demand-side EU energy policy. This cannot but have far-reaching ramifications for the amply politicised and securitised gas trade with Russia as well as for furthering the internal EU market architecture. It is expected that it will decrease flows of energy as well as dependence on Russian gas in the medium term while at the same time acting as a stimulus for further market integration in the energy, climate, and digital economy realms.

Giving civil society a greater voice is imperative for the energy transition to happen. Below are some of the necessary actions:

1) Speeding up action on the ground and localising global agendas;
2) More alliances between countries and donors in the decarbonisation process;
3) Greater collaboration between civil society, governments, and NGOs to include all layers of governance;

[63] Lecture given by John Holdren at Harvard University, 2 October 2018.

[64] See for instance the case of Poland, whose main gas company signed a long-term contract in November 2018 to receive deliveries of liquefied natural gas from the United States as part of a larger effort to reduce its energy dependence on Russia [216].

4) Bringing together different camps of governments;
5) Scaling up the capacity of local governments;
6) Webbing[65] will be necessary: we need to look at issues and challenges, not sectors; temporal linkages are required, namely using time as an indicator, given its importance in the context of decarbonisation, and there needs to be policy coherence.

Finally, in the future, energy will be consumed near where it is produced. How will this impact international trade (in energy), especially in an era of trade restrictions? Furthermore, the protectionist concept of "buy local" seems to be going global. This policy is suggested, among other things, to reduce greenhouse gas emissions from transportation, which will benefit climate change. But, in the international trade domain, there are no winners with protectionism.

What implications will 'buy local' have for international trade at a time when world trade is slowing? Unless there is more innovation in transportation, there is a chance that this policy will result in less demand for international trade. New actors and modes of governance are changing the traditional global trading system, or at least are contributing to the transformation from inter-State dealings to completely different forms of governance in which non-State actors (including individuals) play a role. The EU has been a social laboratory to test hypotheses of multi-level governance in the past, which are pertinent for the case of energy transition. The issues raised above are all very relevant to a future research agenda in the broad field of international economic law and governance.

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[65] By webbing, we are referring to connecting different issues in a broader policy approach, rather than approaching them in silos.

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