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Energy Policies in the Context of Sustainable Development

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1. Definition

Energy is often referred to as the "lifeblood of our society" (Gramlich 2012, 371). Hence it represents a significant component of economic development. One of the state´s key objectives is therefore to develop policies and strategies to balance the country´s energy supply and consumption. Thus energy policy concerns all activities of the energy industry including the extraction and development of resources, energy production, the transport and distribution of energy resources, and end products – heat, cold, electricity – as well as the consumption of energy on both industrial and small scales (Goldemberg and Johansson 2004; Owen 2014, 1). However, in addition to the activities of the energy industry, small-scale consumer-producers of energy such as owners of rooftop solar PV panels or energy communities selling part of their power or heat production to the grid operator also matter for energy policy (see section 3 below). At the same time, the main policy choices, measures, and instruments used vary across countries depending on the domestically available energy resources, population growth, economic performance, energy infrastructure, technical development, government policies, legislation standards, social preferences, and other factors (Woyke 2004, 177-178; Dinçer and Zamfirescu 2011, 51). Energy policy therefore spans several sectors of policy including *inter alia* economic policy, environmental policy, foreign policy, security policy, and social policy. As a consequence of this cross-sectoral nature, a wide range of actors from different fields interact in an attempt to formulate energy policy (Tosun et al. 2015, 4-6).

In the context of developed countries – member states of the Organization of Economic Cooperation and Development (OECD) – energy policy focuses on three key objectives: security of supply, markets, and environmental sustainability. These objectives are prioritized in widely varying ways depending on time and place. The prioritizations also depend on external events (Aalto et al. 2014) and wider political debates (Hermwille 2016).

For example, the security of supply objective became more salient with the oil crisis in 1973 between the Persian Gulf suppliers and the main Western consumer countries, prompting them to strengthen their cooperation. The Russian-Ukrainian disputes on the prices of Russian natural gas and supplies to European markets through Ukraine during the 2000s likewise served to intensify the cooperation among EU Member States, over twenty of which use Russian natural gas. Second, during the 1980s, several countries introduced market reforms as part of their energy policies. By means of liberalizing regulation and privatizing former public utilities, they allowed the proliferation of profit-seeking, stock market listed energy companies competing against each other. This competition was expected to lead to affordable prices for consumers. Third, the last three decades have witnessed anti-nuclear movements and increasing scientific consensus on how greenhouse gases (GHGs) resulting from human activity cause climate change, and how burning fossil fuels in particular deteriorates air quality, shifting the focus towards sustainability.

Today, however, the social implications of energy policy are also emerging (Bilgin 2010). In the developed countries, this social objective pertains to the creation and loss of jobs

in the energy business, notably as new renewable resources are slowly superseding part of the fossil fuel based energy production. Equally important are the associated fiscal consequences in the form of tax revenue to the public sector from energy companies and their employees. In the developing countries the social objectives may moreover relate to issues such as energy access to support well-being, the equitable distribution of wealth accumulated in the various energy sectors and the human rights implications of resource use in ethnically divided or war-torn countries, where some groups may enjoy disproportionate revenues from resources they control (Sovacool 2016). Finally, in developmental states in particular energy policies may have objectives related to the overall modernization of society, technology and industries as may be the case with decisions to develop nuclear energy (Aalto et al. 2017) or a new hydrogen-based energy economy (Demirbas 2017).

The cross-sectoral and dynamic character of energy policy, whereby it affects and is affected by a large number of other factors and actors, eschews any efforts to arrive at a general definition that would fully cover its multi-faceted nature. This may explain why, compared to other related subjects, such as energy security, relatively few definitions of energy policy exist in the literature. They also tend to be short and fairly generic (Prontera 2009; Hoppe et al. 2016; Wang et al. 2016). Some definitions focus on specific aspects, such as the role of non-governmental actors (Mundaca 2008), the international dimensions of energy policy (Pollack et al. 2010; Woyke 2004); while others are clearly normative (Pelegry and Basterra 2014). Among the definitions fully grasping the cross-sectorality of energy policies, Braun and Glidden (2014) state that

> energy policy guides how a country uses energy and from what sources it gets energy. It can be crafted proactively to achieve certain outcomes or reactively to address the already existing problematic issues. The government writes laws, issues orders, or crafts incentives and disincentives to implement and enforce the policy. Energy policy affects transportation, heating, business, households, the military, and imports and exports – in other words, all sectors of the country's economy. Political and environmental issues impact energy policy, and energy policy will also have an impact on the environment (Braun and Gilden 2014; 29-30)

Braun and Gilden further emphasize the role of the government owing to the influence it can exercise over particular energy policies. They also note the context in which governments and all other actors have to operate, pre-defined sources and existing conditions, which may often largely determine energy policies. Finally, they underline the inter-connectivity of energy that respects no economic, political or environmental boundaries. Another definition acknowledging this wide scope proposes that

> Energy policy comprises rules concerning energy sources; energy efficiency; energy prices; energy from abroad; energy infrastructure; and climate and environmental aspects of energy production, utilization, and transit. The main theme in energy policy concerns the trade-offs between affordable, secure, and clean energy. Energy policy is a cross-sectoral—or boundary-spanning—policy area, which means that energy policy has implications for or is affected by decisions taken in adjacent policy areas such as those addressing agriculture, climate, development, economy, environment, external relations, and public health (Tosun 2017, 1)

In the present context, perhaps the most important added value of this definition is the recognition of the trade-offs involved. Indeed, although different policy choices are available final decisions are often marked by competition between various interest groups within society. This includes above all the issue of what sustainable energy a given country can afford to provide without compromising its security of supplies or inflating prices and hence impeding economic activity and the welfare and purchasing power of consumers. In view of such trade-offs, it is possible to dissociate the exact choices for energy policies from the more open-ended, wider debates of energy politics and from the more specific problems of energy security, since the formation of energy policy comprises

> …a series of purposeful actions that manage energy issues either proactively or reactively, resulting in the relative stabilisation of politics (Aalto and Westphal 2007, 6-7). Coping with the associated security issues may often but not automatically be involved. In other words, we take energy policy formation as a more general phenomenon than energy security… (p 2)

2. Why is it difficult to promote sustainable energy policies?

Sustainable energy policies can be associated with the use of energy without endangering the ability of future generations to meet their own needs (Lemaire 2004, 10). Sources of sustainable energy are those that replenish naturally over a short time – in other words, renewable sources – while sustainable energy moreover requires that the practices by which it is exploited do not significantly damage the environment (see below). Renewable energy sources (e.g. wind and solar power) are also carbon free, or can be considered carbon neutral if their use does not result in net release of carbon dioxide into the atmosphere. Regarding the combustion of biomass, however, the record varies between different types of biomass, the methods for its collection, and the associated effects on the carbon sink in the case of forest-based biomass. Nuclear power is likewise mostly carbon free but is neither particularly sustainable (in terms of the excavation of uranium or producing nuclear waste) nor renewable (in terms of the finite uranium resources).

With these specifications, sustainable energy policies refer to policies prioritizing the environmental sustainability objective over the security supply, market and social objectives while in practice remaining firmly rooted in them. First, the environmental sustainability objective depends on how large a population needs to be supplied, on the level of expected living standards, ways of life and corresponding energy consumption of that population, as well as the country's geographical conditions influencing which resources can be taken into use – whether solar, hydropower, wind power, and so on. Taken together, these factors determine the required volume of supplies and the appropriate technologies accounting for the supply, with tangible environmental effects. Second, the market objective is implicated in the need for cost-benefit analyses and life-cycle assessments to provide insight into the efficient use of resources; prospects for the re-use and recycling of resources are likewise relevant. Third, the social objectives pertain to the intergenerational and interregional effects of a given solution which may have immediate or long-term, local or global environmental impacts (Hammond and Jones 2011). The intergenerational effects involved moreover influence how sustainable energy policies at their best feature a journey to the desired end state of sustainability. This end state is remote indeed from current energy policies; on a global scale, finite resources are used at a much faster rate than they are redeposited into the biosphere and the Earth's geology (ibid.). In other words, the production, distribution, and consumption of energy always has some environmental, intended or unintended, negative environmental consequences (externalities).

The task of formulating sustainable energy policies is challenging due to the presence of multiple uncertainties (Aalto 2007). Decision-makers have imperfect information on both individual solutions vis-à-vis the production, distribution and consumption sectors, and the cross-effects of possible combinations of individual solutions within the system as a whole (Toivanen et al. 2017). What is more, imperfect information prevails regarding the impacts of policy intervention in one domain that is supposed to bring a desired change (Purkus 2016, 74-75). It is the task of sustainable energy policies to try to overcome these uncertainties throughout the whole energy system from production to distribution and consumption.

As for production, even though the energy policies of the 2010s as a rule seek to increase the share of renewable energy since it generally releases less GHGs than burning fossil fuels, several uncertainties remain regarding the other environmental impacts. To take an example, solar PV cells and onshore wind power will most likely be the two most rapidly growing sectors of renewable energy when the world seeks to meet the commitments made in Paris in 2015 to delimit global warming to 2°C (IEA 2016, 39). However, since wind and solar power provide variable – often called intermittent – power that is dependent on weather conditions, their deployment is subject to the availability of environmentally sustainable back-up power (in a fossil fuels economy, typically coal or natural gas plants and in a renewable

economy, use of biomass sources). Alternatively, intermittency problems can be resolved by means of various types of energy storage, which, however are globally in a very early phase of development. Since renewable resources are typically scattered over different locations, their distribution to consumers may involve further environmental issues (see below). This in turn may encounter significant problems of public acceptance (Schmid et al. 2016). Renewable energy technology also depends on the availability and extraction of scarce materials such as rare earths, whose prices peaked again during 2017, with demand expected to rise further. Supplies come predominantly from China. These resources are also difficult to substitute while many of them have low recycling rates (Marscheider-Weidemann et al. 2016). Solar and wind power parks also have environmental effects in being more land intensive than the production and use of fossil fuels or uranium. Wind farms and rooftop solar PV installations on existing buildings have landscape implications even though they allow other concurrent economic activities in the same area or property. In a scenario where 80 percent of the electricity consumed in the USA would be renewably produced, the gross land use would be three percent of the US soil (Arent et al. 2014, 372). In the case of biomass and biofuel-based solutions, much graver uncertainties remain of the associated GHG and other environmental impacts including effects on food security if agricultural land is used for growing crops for energy production (Purkus 2016).

In the distribution sector, sustainable energy policies have to prioritize between centralized and decentralized energy solutions – the latter are sometimes called distributed energy systems. Many developed countries have centralized systems consisting of large power plants converting fuels into electricity effectively and high-voltage power lines distributing it to the consumers. In some, mostly northern countries, the combined production of heat and power (CHP) increases the efficiency of conversion of resources in combustion since such technologies can utilize the heat that is a side-product of electricity generation through combustion. Or then, natural gas that is often used for heating purposes is transported thousands of kilometres from the source of production to the local distribution network with some losses *en route*. Furthermore, the chains of transport fuel production and distribution often extend thousands of kilometers. Distributed energy, for example micro-generation by means of solar PV or small bio-CHP plants can reduce the losses of power, heat or gas along the way and enhance the use of locally available, more sustainable resources (Hammond and Jones 2011, 36-39). However, many questions regarding resource efficiency arise in the transformation of existing centralized infrastructure in developed countries. Considerable financial resources and extensive raw materials are required to build high-voltage power lines connecting, for example, offshore wind power production areas with large inland cities, or to interconnect the electric energy systems of different states with each other to balance off regional differences in the production and consumption patterns, especially with increasingly intermittent power (Nordensvärd and Urban 2015). In the developing countries, decentralized solutions may have considerable potential alongside different micro-grid solutions (Eid 2016).

In the consumption sector, several possible choices are available for sustainable energy policies. First, policies can penalize consumption high in GHG emissions, such as the use of internal combustion engine vehicles burning gasoline or diesel and introduce taxes and bans to curtail their use and instead incentivize alternative modes of transport. However, the environmental sustainability of these alternatives is uncertain. Different types of biomass as a raw material for biofuels involve highly variable GHG emissions throughout the whole extraction, production, and distribution chain. Bio-gas based solutions may be suitable especially for long-distance transport but face similar questions. The climatic sustainability gains of electric vehicles for their part depend on how high a share of electricity is renewably and climate neutrally produced (Mersky et al. 2016). Second, policies can also incentivize energy efficiency measures in electric appliances, vehicles, and buildings – which is the choice so far favored by the automobile industry. However, uncertainty relates here to the rebound effect, whereby the more efficient use of energy may in fact induce consumers to use more energy. Evidence-based estimates of such a rebound effect are uncertain and vary from sector to sector: from 5-87 percent in the personal automotive transport to 1-60 percent in space heating (Fawkes 2013, 70-2). Third, policies can introduce flexibility measures for managing

consumption and using existing energy flows more effectively. For example, the batteries of electric vehicles could function as an electricity storage resource for the system if the cars are connected to the grid while parked (currently, some 95 percent of the time). Or then, automation of electricity networks can help to identify where consumption can be temporarily halted or decreased in order to reduce peak load consumption in the electric energy system (Toivanen et al. 2017).

Overall, Purkus (2016, 390) suggests that from a governance perspective a combination of policy measures is the most realistic way of improving the sustainability of energy policies; focusing on single measures is unlikely to be acceptable to users, stakeholders, and their representatives.

3. How does governance within-the-state affect sustainable energy policies?

Within states, energy is traditionally a strategic resource. Hence, energy policy is mostly interventionist in this area, where competitive markets are a relatively recent phenomenon, and most often found in the OECD states and best developed in the context of the oil sector. To the extent that competitive energy markets have formed, states have sought to correct market failures, for example upon perceiving threats to the security of supply objective. At the same time, energy policy seeks to serve wider societal objectives, as discussed above. In this respect, the energy sector often differs from other industrial sectors where market mechanisms tend to prevail (Prontera 2009, 6). This is not to say that energy policy is determined exclusively by the decisions and measures of political decision-makers and civil servants. Firms and interest groups also seek to influence energy policy in order to promote their own interests (Ruostetsaari 2009). Even though fully or partly state-owned energy companies play an important role in the energy sector in many OECD and developing countries, governments cannot unilaterally enforce their policies since they must take into account the interconnections between energy and other industrial sectors and the vested interests therein (Moe 2015). That energy companies nevertheless increasingly operate in market-based or marketising environments further constrains the room of manoeuver of state institutions.

As governmental institutions are not the only actors influencing energy policy, it can be viewed from the perspectives of governance and policy networks. Governance is a theoretical perspective highlighting the role of the political system. The concept of policy network refers to the need for cooperation between governmental (politicians, authorities), collective actors (interest groups), and market-based actors (firms) in solving collective problems and taking responsibility for the well-being of society. This means that the actors in the political system and its environment are not only intertwined but are also heavily dependent upon each other. It is no longer the state which is necessarily the primary and dominant actor in politics. Rather, these tasks and responsibilities are often shared and coordinated in less conventional ways and through multilayered networks (Micheletti 2003, 5-7).

A simple but useful distinction can be made between the official energy policy and unofficial policies affecting the energy sector. The former can be defined as a strategy, clearly elaborated and explicitly formulated by the government, to serve the various objectives of energy policy (see above). In many cases this implies a commitment to a series of specific investment and technology choices, and the coordination of the activities of different energy producing sectors. The latter involves the policies governments adopt for a plethora of further reasons that simultaneously influence the various energy sectors and the firms operating within them, as well as the energy balance, both intentionally and accidentally (Prontera 2009, 2-3).

It is fair to say that big business representing energy supply and demand has most effectively exercised such unofficial energy policies vis-à-vis governments. This means relatively high organizational barriers to more extensive interest representation when compared with other policy domains (Chubb 1983, 258-259). Some firms, especially state-owned and more generally, those operating in energy supply, traditionally enjoy privileged

access to decision-making arenas, which have remained mostly opaque to the average citizen (Prontera 2009, 23; Ruostetsaari 2009).

However, when looking from the perspective of governance and especially acknowledging some recent developments in the energy sector, this traditional pattern of power wielding is challenged. The increasing role of renewable energy in the energy supply, such as wind power and solar PV, increases the number of actors (e.g. foreign investors), creates completely new actors (e.g. service producers installing solar PV panels or serving wind power parks), and changes the role of established energy producers as they have to compete with new renewable forms of production (e.g. wind power which has close to zero production costs, as opposed to the costs of running large power plants, and which often subsumes all other forms of power in the market when abundantly available). Moreover, large industrial energy consumers may be economically incentivized to reduce or cut their electricity consumption during peak demand periods via demand response mechanisms. Consumer-citizens, for their part, may assume new roles by becoming small-scale producer-consumers (prosumers) (Toffler 1980), or by becoming activist political consumers (e.g. switching power suppliers on ethical or financial grounds).

The increasing decentralization of the energy system and the citizens' changing attitudes to political involvement modify the role of the citizenry from traditional consumers more and more towards that of active consumers and prosumers. Prosumers can themselves, for instance, produce electricity by means of solar panels, store electricity in a battery storage or in the battery of an electric car, sell their surplus electricity to the power grid or other consumers within an energy community, or participate by means of flexible consumption in various electricity markets (Parag and Sovacool 2016). This may reduce the demand for power produced by established actors and influence the power balances and flows in the grids they operate – while they still may need to be able to provide power when prosumers cannot produce enough for their own needs. The need for flexibility and demand response will increase, especially as a result of the growing role of wind power and solar power in the energy system and the intermittent nature of their production.

The choices of political consumers are based on attitudes and values concerning issues of justice, fairness, or personal or family well-being, as well as ethical assessments vis-à-vis business and governmental practices. Political consumerism can be defined as "actions taken by those who make choices among producers, products, and services with the aim of changing objectionable institutional or market practices." Consumption can represent a means for people to express themselves politically or set the political agenda of other actors and institutions, such as government and business (Stolle and Micheletti 2013, 39, 24). The concept combines the two traditions of consumption and citizenship, which tended to be located in opposing spheres of private and public life (see Follesdahl 2006).

Popular support for political consumerism is among the highest by international standards in the Nordic countries, Switzerland, and Germany, with Southern and Eastern Europe lagging behind (Stolle and Micheletti 2013). For example, in Finland support for political consumerism as strategy for influencing energy policy-making increased from 45 per cent to 48 per cent in the period 2007-2016 (Ruostetsaari 2018). Because citizens are concerned about climate change and the use of fossil fuels in energy production, there is an obvious increase in pressure from the citizenry for a sustainable energy policy. These individuals may be not only active energy consumers and citizens but also energy producers, that is prosumers, or resource providers if, for example, they allow utilities to use their electric vehicle batteries or boilers as network resources that can be controlled by the operator. The activation of consumer-citizens and the appearance of prosumers do not change rapidly energy policies towards renewable energy or sustainability in general but challenge the legitimacy of the instruments of established energy policies such as energy subsidies and taxes which favor large-scale energy production and consumption.

4. How does governance beyond the state affect sustainable energy policies?

International governance mechanisms enable and inhibit sustainable energy policies on the national level in a variety of ways. While sustainable energy policies are national, their genesis is often in international treaties. The primary example of an international treaty creating a governance framework for sustainable energy law and policy is the UN Framework Convention on Climate Change (UNFCCC), which was adopted in 1992 and entered into force in 1994. The Energy Charter Treaty, adopted in 1994, for its part provides for boundaries for national sustainable energy policy action; it entered into force in 1998. Both of these international legal instruments have a specific role to play vis-à-vis sustainable energy policies and have a direct impact on national policies alongside further hard-law instruments like international trade governance systems, while soft-law or information based international governance systems exercise mostly indirect impact on sustainable energy policies as will be reviewed below.

4.1 The UN Framework Convention on Climate Change

The UNFCCC provides a wide framework for policy action for climate change mitigation. It has led to a number of important international mechanisms directly or indirectly supporting sustainable energy policies. For example, it supports sustainable energy initiatives through the Technology Mechanism (UNFCCC 2018*) and funding through the Financial Mechanism (UNFCCC 2018; see UNFCCC 2012). The majority of the technical assistance has been energy related (CTCN 2015). Many of the intended nationally determined contributions (INDCs) in the UNFCCC context concern renewable energy deployment (for example, feed-in tariffs and investment in renewable generation and grid infrastructure), as well as energy efficiency (UNFCCC 2015). The 2015 Paris Agreement (COP 21) reinforces the international cooperation in this area, including in terms of financial support (Leal-Arcas and Minas 2016).

4.2 The Energy Charter Treaty

The Energy Charter Treaty (ECT) is an energy specific international treaty with 54 signatories. It is an energy-specific multilateral treaty covering issues like free trade in energy-related products, freedom of transit, the protection and promotion of foreign investment, and dispute settlement. While some of the provisions of the ECT have not caused much practical impact and lain quite dormant, its provisions on energy investment protection are frequently used today. This is particularly so with renewable energy investments. There are currently approximately 30 renewable energy cases pending under the ECT against Spain, around 10 against the Czech Republic and Italy and one against Bulgaria (Talus 2016).

In terms of international governance, the ECT's role is to lay down the conditions and limits for state intervention in the renewable energy sector. Enforced through international arbitral tribunals, the checks and balances in place offer a degree of investment certainty in this area. In this sense, the treaty functions like a national administrative or constitutional law review of regulatory and policy measures. The fact that government subsidies provide the backbone for renewable energy investment makes such investment particularly vulnerable to changes in law and policy. While changes in national policies are always possible, the ECT provides a framework that ensures that changes in these policies are not unfair to those investors that have relied on specific policies and regulatory frameworks.

4.3 The World Trade Organization (WTO) framework

If the UNFCCC provides for the impetus for renewable energy and the ECT for protection against detrimental policy changes, international trade law also has a role to play. It ensures that national policies do not create undue advantages to national actors at the expense of international investors. National renewable energy schemes have been the subject of proceedings at the level of the World Trade Organization (WTO) in a growing number of disputes. *Dispute DS412, Canada — Certain Measures Affecting the Renewable Energy Generation Sector* involved Canadian domestic content requirements. *Dispute DS452,*

European Union and Certain Member States — Certain Measures Affecting the Renewable Energy Generation Sector featured China raising somewhat similar questions vis-à-vis the EU feed-in tariff scheme. The EU Member States' feed-in tariff programs include domestic content restrictions that affect the renewable energy generation sector. Italy and Greece are only two examples of the many disputes initiated under the WTO framework.

4.4 The International Renewable Energy Agency (IRENA)

The International Renewable Energy Agency (IRENA) is an intergovernmental organization supporting governments in their efforts to create sustainable energy policies. Unlike some other international organizations, such as the oil producer dominated Organization of Petroleum Exporting Countries (OPEC), and the International Energy Agency (IEA), consisting mostly of OECD Member States, the role of IRENA is restricted to supporting governments through information; therefore, it has no regulatory capacities. It supports global governance primarily by conducting studies, providing statistics and by means of helping to promote technology.

4.5 Interlinkages between the international and national levels

Sustainable energy policies depend on developments on the international level in terms of transfer of ideas, knowledge and technology as well as policy diffusion (Kern and Markard 2016, 300-301). The markets of sustainable energy also become more international, as adjacent countries trade in renewably produced electricity, as is increasingly the case in the EU, or trade in relevant technologies, equipment, solutions, and services, while investment in sustainable energy infrastructure also frequently comes from the international level. This all means that still further international law instruments become relevant. International trade law and the growing number of trade disputes in renewable energy have an inhibiting effect on national policies, to the extent that these favor national actors over international. The UN Law of the Sea Convention (UNCLOS) has become relevant with wind energy moving offshore. It provides for the rights and obligations of coastal states in relation to offshore wind projects.

National policies and industrial activities can also prompt changes on the international level. Shale gas is an example of such dynamics and the involved ambiguities. It is not carbon free and at least to some extent competes with renewables, making it at best a transition fuel in the context of sustainability (Smil 2015), yet its use emits less GHGs than that of coal or oil, which it can substitute. The so-called shale gas revolution in the United States was a result of both government policies to facilitate the development of unconventional hydrocarbon resources and efforts of the industry. Nationally, this abundant gas resource has substituted some coal production. Internationally, it has made larger volumes available for the global markets of liquefied natural gas (LNG). This has enabled countries like Malta, which previously used oil products to electrify the island, to switch to LNG based natural gas. At the same time, LNG has become a viable option for maritime transport in place of oil-based fuels. International governance in this area has been primarily driven by the new rules under the International Maritime Organization that cut the allowed Sulphur content in marine fuel to 0.5 percent from 3.5 percent by January 2020. Hence, this case shows how national policies and industry developments can combine with international energy governance to enable a more sustainable alternative to maritime transport while other options like the use of biofuels, electrification and rotor sail technologies have limitations of their own.

5. Summary

Energy policies serve wide-ranging societal objectives including security of supply, issues related to markets and prices, environmental sustainability as well as a variety of social objectives. Because of this cross-sectoral nature and the large number of actors affected, energy policies are difficult to define exhaustively. With these limitations, energy policies concern the purposeful actions of governments to manage energy issues in a stable manner acknowledging the trade-offs between the various objectives of energy policy. Sustainable energy policies

furthermore prioritize the environmental sustainability objective over others. This means utilizing renewable resources without causing major damage to the environment and not increasing the net release of carbon dioxide into the atmosphere. The conduct of energy policies in such ways is, however, fraught with uncertainties inherent in the production, distribution and consumption sectors of the energy system. Further challenges emerge because the vested interests of firms and other groups within society influence the conduct of energy policy-making while increasing citizen activism, especially in the developed world, typically stresses the sustainability of policies. Global governance also features several international institutions and treaties inducing governments to pay more attention to sustainability in their energy policies. At the same time, national level processes continue to have multiple and often ambiguous effects on the international governance of energy policies, as witnessed, for example, in the case of shale gas.

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Cross-references
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