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Energy security and climate change: Conflicting or complementary energy policy objectives?

Abstract

Energy security and climate change have become core energy policy objectives. Despite arising conflicts both objectives have predominantly been framed as complementary in the policy debate. In the context of energy security potential policy trade-offs have mostly been discussed in relation to market liberalisation objectives and sufficient incentives for new investments. On the other hand, climate change policies and their costs have been discussed against economic competitiveness, growth and employment while often neglecting indirect benefits. The Stern report, by highlighting the potential societal costs if no or insufficient action against rising GHG emissions is taken, and security concerns related to climate change contributed to a certain shift in this perspective. This paper aims to contribute a better understanding of the potential trade-offs and synergies between energy security and climate protection as core energy policy objectives and how these relate to energy policy processes at a conceptual level.

1 Introduction

Energy security and climate change have become core objectives of UK and European energy policy. Increasing dependence on imported fossil fuels in the context of recent 'energy crises' and soaring fossil fuel prices has raised questions about the long-term security of energy supplies (e.g. CEC, 2006; DTI, 2007). At the same time more

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evidence on anthropogenic dangerous climate change has underlined the need to reduce energy related GHG emissions as a result of fossil fuel combustion which contribute over two thirds to total global GHG emissions and are projected to rise by over 50% by 2030 (Sims, Schock et al., 2007: 252). The integration of energy security and climate change policies is therefore a central challenge for energy policy.

Although both objectives can work together, there are trade-offs that have been insufficiently considered so far. In the past potential policy trade-offs have been discussed mainly with respect to other energy policy objectives. On the one hand, energy security objectives have mostly been discussed in relation to liberalised market objectives and sufficient levels of investment. It raised questions about the potential tension between liberalised market frameworks and energy security (e.g. NERA, 2002). On the other hand, climate change policies have been discussed in relation to their costs and detrimental consequences for economic competitiveness, growth and employment while often neglecting indirect benefits (Jochem and Madlener, 2003). Discussions on the relationship between energy security and climate change tended to consider energy security as policy priority to which climate change policies should contribute. Yet, increased attention on the potential economic consequences of anthropogenic dangerous climate change (Stern, 2007) and on its implication for national and international security (Council, 2008) have questioned this ranking order.

The aim of this paper is to contribute to the discussion on potential trade-offs and synergies between energy security and climate change policies. It argues that the relationship between energy security and climate change have predominantly been analysed from an energy security perspective strongly focused on energy independence while neglecting other element of energy security. By taking into account the broader context of energy security, the paper further argues that the climate change-energy security nexus requires more attention on climate change adaptation policies. The paper is based on ongoing work that intends to investigate how and to what effect in terms of policy outputs and outcomes energy security and climate change are used as frames in the policy process. A very brief theoretical background indicates how the conceptual discussion presented in this paper can serve as basis for an empirical analysis of energy policy processes.

The paper is structured as follows. First, it briefly discusses the role of frames in policy processes. It then reviews the literature on definitions of and strategies for energy security. In a next step the paper reflects on the gradual integration of energy policy and climate change policies, before the relationship between energy security and climate change is looked at in more detail. The final section provides some preliminary conclusions.

2 The role of frames in the policy process

Energy security is prone to multiple perspectives as regards its problem definition, solutions and means of implementing them. It is thus particularly exposed to appropriation by stakeholders in the policy process. In other words: an imprecise concept like energy security that is considered as "one of the most overused and misunderstood concepts in the energy debate" (Helm, 2002: 175) is prone to be used by policy entrepreneurs to push for their 'pet proposal' in the policy process. Or as put elsewhere: "experience has shown that, by highlighting the claimed [energy] security benefits of an otherwise disfavoured option, big rewards can be yielded to political advocacy” (Stirling, 1993: 57).

Problem definition has long been recognised as central elements in the analysis of policy processes (e.g. Weiss, 1989; Rochefort and Cobb, 1994). Problem definition fulfils three crucial roles in the policy process: first, it defines the intellectual framework at the beginning of the policy process within which an issue is discussed as a problem, second, it is as process itself constituting "a weapon of advocacy and consensus" (Weiss, 1989: 117), and, finally, it can be an outcome of policymaking in terms of changed definitions and language as well as changed advocacy structures. The chances of a problem to attract the attention of particular political institutions which all have different selection procedures will be influenced by problem definition and thus affects policy outcomes (Rochefort and Cobb, 1994). The dominant problem definition has important ramifications for policy solutions and their alternatives as well as how they are implemented.

Similar to problem definition, framing can be defined as “[…] a way of selecting, organizing, interpreting, and making sense of a complex reality so as to provide guideposts for knowing, analysing, persuading, and acting. A frame is a perspective from which an amorphous, ill-defined problematic situation can be made sense of and acted upon” (Rein and Schon, 1991: 263). Frames used in the policy process can reveal causal relations actors establish between particular policy proposals and policy problems. Thus the major aim of frame-critical analysis is to identify the underlying assumptions of actors or advocacy groups in the policy process which allows them to put certain policy proposals on the governmental decision agenda.

Against this background the following conceptual discussion of energy security can provide a framework for an empirical analysis of energy policy process and the role of the various elements of energy security as frame with particular consideration of climate change policy objectives.

3 Energy policy and energy security

3.1 Energy security – what problem?

In their analysis of energy security in Western Europe published in 1981, Deese and Miller (1981) suggest five indicators for the analysis of energy security defined as “access to adequate amounts of hydrocarbons at a price that ensures a standard of living and rate of industrial growth comparable to that enjoyed since the 1960s” (Deese and Miller, 1981: 182). A similar, although slightly more elaborated, definition is given elsewhere:

> "Energy security is a state in which consumers and their governments believe, and have reason to believe, that there are adequate reserves and production and distribution facilities available to meet their requirements in the foreseeable future, from sources at home or abroad, at costs which do not put them at a competitive disadvantage or otherwise threaten their well-being.” (Belgrave, Ebinger et al., 1987: 2)

Sufficient quantities of supplies at affordable prices are central elements in these definitions of energy security. Narrow definitions of energy security were already criticised in the 1980s for being only about oil (neglecting gas), fuel (neglecting conversion technology), imports (neglecting domestic infrastructure), and physical supply (neglecting comparative cost advantages). This is reflected in definitions of energy security that acknowledges net benefits in terms of both economic and social welfare:

> "Security, in any connection, is about the relationship between values or assets, on the one hand, including the asset of freedom to shape future circumstances, and actual or potential threats, on the other hand." (Smart, 1985: 146)

Energy security can therefore be considered as contributing to several policy objectives. Going one step further, energy security might even been seen as a necessary condition to achieve other policy objectives:

> "Insecurity arises when the welfare of citizens or the ability of governments to pursue their other normal objectives is threatened, either as a result of physical failure or as a result of sudden and major price changes." (Belgrave, Ebinger et al., 1987: 2)

While until the late 1990s the discussion on 'energy security' focused heavily on the supply side and the geopolitical situation mainly in relation to fossil fuel exporting countries, an arising issue driven by power blackouts in California was the extent to which liberalised energy market frameworks can provide enough investment incentives to ensure a sufficient level of 'energy security'. From this perspective it is not only about the secure supply of imported hydrocarbons, but also about the availability and reliability of domestic conversion technologies and supply infrastructure including distribution and transmission networks.

The argument that fossil imports do not equate vulnerability in terms of energy supply became more important. Although this point has already been made in earlier contributions to the debate (e.g. Nye, 1981), it started only then to attract considerable attention. This point is also highlighted in an increasing number of recent publications that underline that energy dependence in itself is not necessarily a problem (e.g. Stern, 2002; Keppler, 2007; Verrastro and Ladislaw, 2007). Energy independence and a strategic approach to energy security are even considered as "myths of energy security" (Noel, 2008).

3.2 Strategies for energy security

Strategies and measures that enhance energy security will inherently depend on the underlying energy security concept. They can be categorised in many different ways. Predominant distinctions in the debate are between demand and supply side, internal and external, preventive (how to avoid disruptions?) and mitigating (how to deal with disruptions and avoid negative consequences?) as well as short term and long-term measures. Stirling (1993) suggests a further distinction according to intervention targets along the fuel supply chain: resource acquisition, fuel trade & delivery, energy conversion, energy distribution, and energy consumption. Individual measures are more or less repetitive in the literature with varying emphasis on specific measures.

Policies in support of decreasing energy imports are considered as being expensive while at the same time not providing real benefits. To deal with the mid-term risk of scarce oil and gas supply and the short-term risk of oil supply disruption, the following strategies are put forward (Noel, 2008): in the mid-term higher taxes on oil, better efficiency standards as well as increased use of alternative technologies, in the short-term new emergency storage facilities. Mitchell (2002) argues that for importing countries diversity and flexibility of energy supplies achieved “mainly by international trade and the investment necessary to support it” (Mitchell, 2002: 25) are the major ways to achieve energy security. As a consequence, international energy markets and their transparency, liquidity and stability need to be taken into account as well. Yergin (2006) argues that the traditional principle prevalent since the 1970s to maintain energy security (diversification of supply, resilience, recognising the reality of integration, and the importance of information for the markets) need to be expanded to acknowledge two new aspects: first, the globalisation of energy security with China and India as important players, and second, the importance of the entire energy supply chain in the wake of terrorist attacks.

The debate about potential conflicts between a liberalised framework for energy markets and energy security raised the question how an ‘adequate’ level for security of supply can be determined in order to adjust the policy and regulatory framework accordingly. In this context risk has been suggested as a measure of energy security. From this perspective an energy system can be considered as secure if the risk for supply disruption is acceptable and the price to pay reflects the cost of provision (NERA, 2002). Energy security becomes subject to risk management where an acceptable risk level is to be set.

Stirling (1994) questions the usefulness of risk as concept to deal with security of supply in the electricity sector. He refers to two other concepts of incertitude – in addition to risk: uncertainty and ignorance. He argues that ignorance is the most relevant concept to deal with strategic security. Hence, diversity is best placed to provide resilience to the electricity system. The diversity concept can be distinguished into the following subcategories: variety, balance, and disparity where variety is defined in terms of the number of available options, balance in terms of each option being relied upon to a similar extent, and disparity in terms of the identification and disaggregation of options themselves. The latter seems most important and underlines the concepts of variety and balance since it calls to take into account “similarities of [each technology’s] technical characteristics, the degrees to which they are dependent on each other’s infrastructures and the mutual elasticities (or covariance) in the costs of their fuels” (Stirling, 1994: 198). Diversity can be defined more specifically in terms of fuel type, fuel sources (by geographic region or company), technology types or even to technological knowledge source (by country, sector, or economy) (Grubb, Butler et al., 2006).

However, as for the energy security concept itself “no concept is more vulnerable to distortion for the purposes of special pleading than is ‘diversity’” (Stirling, 1993: 68). A comprehensive approach to diversity that includes technology features such as variable power output from wind turbines depending on the weather situation would ensure that, for example, system characteristics such as robustness in the context of physical reliability are achieved. Other important system features are flexibility and responsiveness in the context of competitive market behaviour. A risk perspective leads inevitably to an insurance analogy and the question about the insurance premium consumers are prepared to pay for a certain level of energy security.

From this discussion three main energy security policy objectives can be derived:

- sufficient investment along the fuel supply chain (flexibility and responsiveness in the context of competitive market behaviour) which contributes also to
- a reliable infrastructure / technologies
- diversity defined in terms of fuel type, fuel sources (by geographic region or company), technology types, and technological knowledge source (by country, sector, or economy)

In sum, there are essential elements that need to be considered when dealing with energy security of a given region or nation. Energy security lacks (a) well-established indicator(s). Various indicators have been used to measure energy security (e.g. JESS, 2004; IEA, 2007). This reinforces opportunities to establish different frames for energy security in the energy policy and climate change debate. Any analysis of energy security needs to take a system's approach instead of focusing on single aspects such as import dependence or investment levels. Furthermore it needs to distinguish between different time horizons (at least, short- and long-term). Given the differences in national perception of energy security approaches, it is important to acknowledge that the underlying concept is "functional in respect of these different circumstances and allow the general abstract objectives and priorities of energy policy to be met" (Correlje and van der Linde, 2006: 542).

This section has shown that energy security is prone to be framed in very different ways at the level of problem definition and strategic options. The way in which energy security is framed as a problem has therefore important ramifications how it relates to climate change objectives.

4 Energy policy and climate change

As compared to energy security where the factors to determine the degree of energy security can be defined in a variety of ways and can therefore be subject to frame contestation, climate change 'benefits' from a clear indicator: the atmospheric level of GHG emissions. Rising anthropogenic GHG emissions are generally recognised as the causal factor for dangerous climate change. As a consequence climate change policy has a central indicator against which climate change mitigation policies can be developed. The level of contestation is less related on how to define climate change and its underlying causes. A broad scientific consensus serves as baseline, although the target level of GHG emissions, the choice of policy instruments to achieve agreed emission targets and how to share the burden globally among industrialised and developing countries are subject to conflict.

In contrast to energy security that has been accepted as core energy policy objective since the first oil crisis in the early 1970s (although its prominence has decreased in the 1990s due to overcapacity and cheap fossil fuel prices), climate change objectives have only gradually (if at all) been integrated with energy policy in terms of institutional frameworks or energy policy discourses. Although the link between energy policy and climate change policy is apparent, climate change policy has long been considered as being part of environmental policy and traditional air-pollution. This is reflected in the institutionalisation of responsibilities: environment ministries are in most cases responsible for climate change policy and ministries for the economy responsible for energy policy and energy security in particular. This environmental policy approach to climate change has shown its limits since carbon dioxide as the main source of pollution cannot be subject to traditional air pollution control-type regulation. As a consequence, “energy policy must be the backbone of climate stabilization” as already put in 1990 (Krause, Bach et al., 1990: I. 2-29). This conclusion has only gradually been incorporated in the energy policy process, but is reinforced by recent IPPC figures. Energy related GHG emissions as a result of fossil fuel combustion are responsible for over two thirds of total global GHG emissions. These emissions are projected to rise by over 50% by 2030 (Sims, Schock et al., 2007: 252).

An increasing awareness that climate change policy needs to become energy policy and re-balancing of energy security and climate change objectives in terms of their ranking order was driven by two factors: an emphasis on the potential economic costs and the security implications of dangerous climate change.

The stronger focus on economic consequences of climate change was mainly caused by the publication of the Stern report that stressed the global economic costs, if no action is taken against rising GHG emissions. It put forward the widely reported estimate that business as usual will cause overall costs and risks of climate change equivalent to losing at least 5% of global GDP annually – depending on the assumption this figure could even rise to 20% of GDP. By contrast the costs of action could be as low as 1% of global GDP (Stern, 2007). The emphasis on economic benefits as opposed to costs constitutes major shift within the economic perspective on climate change policies. Traditionally economic studies analysing the costs of GHG mitigation policies emphasised the costs of policy measures. Indirect benefits or ‘co-benefits’ have often been neglected in cost-benefit analyses and modelling exercises of climate change policies (Jochem and Madlener, 2003), although potential benefits have been discussed already in the early 1990s (e.g. Grubb, 1990). These ‘co-benefits’ are increasingly acknowledged can be an important driver for climate change policies. ‘Co-benefits’ include technological innovation, leapfrogging for developing countries, and net employment benefits.

Another element that contributes to a more prominent role of climate change objectives in general is its linkage to national security. Various high-level reports in the US and the EU have highlighted how climate change can constitute a serious threat of national and international security (e.g. Council, 2008). It was even discussed in the UN Security Council for the first time in April 2007 (United Nations, 2007).

Despite this increased attention on climate change objectives in relation to energy security most studies analysing the interface between energy security and climate change objectives investigate to what extent climate change policies impact upon energy security and thus put the priority on energy security objectives. At the same time any conclusion on this relationship will depend on how energy security is defined given the wide-ranging definitions possible as discussed earlier. Previous studies put a relatively strong emphasis on import dependency as main threat to energy security and analyse how climate change policies affect import dependency (Kuik, 2003; Turton and Barreto, 2006). By contrast, Blyth and Hamilton (2006) take an investment perspective and ask how climate change mitigation policy should be formulated in order to influence investments and operational behaviour in the electricity sector. A quantitative attempt to appraise policies in the context of the two policy objectives was made by the IEA (2007); energy security is measured in terms of exposure to fuel markets which are distinguished into two categories: free markets where the price reflects market concentration and the higher the concentration the lower is energy security, and regulated markets (e.g. indexed prices) where a high share of regulated volumes indicates low energy security.

The IPCC report on climate change mitigation policies takes a different perspective and argues that energy security policies' impact on carbon emissions is "ambiguous, depending on the nature of the policies and, in particular, on the fuel sources being favoured" (Sathaye, Najam et al., 2007: 719). As empirical examples it refers to national responses to the first oil price shock in the 1970s in terms of energy security policies and quite different consequences for carbon emissions. The replacement of domestic fossil fuels with imported low carbon energy sources is considered as potential threat to energy security although diversification measures could counter-balance this risk.

In the preface to a policy paper prepared for the G8 the term of "real energy security" is introduced (Grubb, 2008). It aims to address both challenges – climate change and energy security by: a) diversity in supply sources that reduces market dominance and aims at minimising carbon emissions; b) diversity in trade routes and infrastructure; c) significant increase in energy efficiency; and d) reduction and reverse of deforestation. This reflects the three general strategies to achieve both policy objectives: energy efficiency, the support of new low carbon technologies, and a reliable infrastructure capable of meeting demand.

5 Enhancing energy security and addressing climate change

Any assessment of the interface between energy security and climate change needs to integrate the multiple dimension of energy security. Instead of the regularly considered 'import dependence' as measurement of energy security, three main energy security policy objectives can be summarised: sufficient investment along the fuel supply chain, reliable infrastructure, and diversity. Import dependency is only one element in the climate change-energy security equation. From this perspective, non-fossil fuel energy generation technologies (e.g. renewables) that replace imported fossil fuels and energy efficiency measures that reduce demand for imported fossil fuels are only one contribution to both GHG emission reduction and increased energy security. On the other hand, the promotion of carbon intensive domestic energy sources in order to decrease dependence on imported fossil fuels (e.g. coal) is in conflict with climate mitigation strategies. However, other elements of energy security need to be considered too: Sufficient low carbon investment along the fuel supply chain while at the same time ensuring a high degree of reliability of the energy infrastructure as a whole.

By contrast to climate change mitigation policies whose relationship with energy security is regularly touched upon in the literature, climate change adaptation measures have attracted little interest so far. Yet a closer examination shows interesting complementarities in particular because it relates to a broader definition of the energy security concept. This can be exemplified using three major challenges for adaptation policies (see also table below):

- In the case of increased likelihood of weather extremes an energy infrastructure that does not depend on a few nodal points, whose ‘knock out’ would affect the majority if not all system participants, increases energy security. It points at the importance of a more distributed energy generation which can be more suitable to cope with the failure of individual parts of the system.

- Rising sea levels as well as summer droughts might cause serious safety issues for nuclear power plants to be built for energy security and climate change mitigation reasons. Flooding of a nuclear power station as well as insufficient cooling water might seriously affect the safe operation of the power plant. Energy policies integrating climate mitigation and energy security objectives can therefore be in conflict with climate adaptation policies.

- Forest and agriculture sectors need to be able to ensure future availability of biomass and biofuels resources which are currently promoted for energy security (decreasing import dependence) and climate protection reasons.

Table: Interaction between climate change adaptation policies and energy security

Adaptation policies	Interaction with energy security
Water resources	
River basin planning and coordination	Flooding of nuclear reactors
Contingency planning for drought	Cooling for thermal power plants
Marginal changes in construction of infrastructure	Energy infrastructure / flexibility
Options for new dam sites	Protection of nuclear reactors
Sea-level rise	
Plan urban growth	Energy infrastructure / flexibility
Forests	
Diverse management practices	Biomass
Agriculture	
New crops and seed banks	2nd generation biofuels
Increase irrigation efficiency	Biomass/biofuels
Liberalize agricultural trade	Free trade of bio-energy products
Drought management	Biomass

Source: own elaboration, adaptation policies based on (Smith and Lenhart, 1996: 200)

6 Conclusions

A broader understanding of energy security is necessary to fully grasp the relationship between energy security and climate change policy objectives. It has been recognised that import dependency is only one element when assessing energy security. Energy security is as much about sufficient investments and a reliable infrastructure (including technologies). In addition climate change related issues have attracted more attention since the potential consequences of anthropogenic dangerous climate change have been linked to core policy objectives such as economic growth and national security. Thus both have become important objectives and frames in energy policy processes. The conceptual discussion in this paper constitutes a first step in analysing the role of these frames in policy processes empirically. The conceptual understanding of their potential trade-offs and synergies enables the analysis of how frames are used by different players in the energy policy process and for what purpose.

From the conceptual discussion it can be concluded that instead of only focusing on the question how climate change policies might interfere with energy security objectives – what appears to be the dominant perspective in the debate – energy security policies need to be assessed against their impact on and relation to climate change objectives. This in turn highlights the challenge to consider both climate mitigation and adaptation objectives as well as strategies. The opportunities to achieve this in energy policy processes depend also on the institutional framework. The institutional setting influences the extent to which certain problem definitions and policy objectives become part of the political agenda.

For further research on the role of frames in energy policy process, one basic assumption is that frames can explain policy outputs and potentially outcomes. However, as argued by Schmitt and Radaelli (2004) frames reflected in policy discourse can only be *a* cause for policy change, but not *the* cause. Frames need therefore to be analysed within a broader range of explanatory factors for policy change. Other factors that are to be considered when analysing energy policy processes empirically against the above background include institutions, geographical factors/energy resources, as well as norms, values, and beliefs.

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