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Punctuated equilibrium in the energy regime complex

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Abstract The concept of a regime complex has proved fruitful to a burgeoning literature in international relations, but it has also opened up new questions about how and why they develop over time. This article describes the history of the energy regime complex as it has changed over the past 40 years, and interprets this history in light of an interpretive framework of the sources of institutional change. One of its principal contributions is to highlight what Stephen Krasner referred to as a pattern of "punctuated equilibrium" reflecting both periods of stasis and periods of innovation, as opposed to a gradual process of change. We show that the timing of innovation depends on dissatisfaction and shocks and that the nature of innovation—that is, whether it is path-dependent or *de novo*—depends on interest homogeneity among major actors. This paper is the first to demonstrate the empirical applicability of the punctuated equilibrium concept to international regime complexes, and contributes to the eventual development of a dynamic theory of change in regime complexes.

Keywords Regime complex · Energy · Institutional innovation · Institutional design · Oil · Punctuated equilibrium · Path dependence

JEL Classification F50 · F53 · F55 · F59 · N70 · Q48 · Q49

1 Introduction

Increasing globalization and interdependence give rise to a heightened demand for formal organizations and informal networks of state and non-state actors, within a

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state system characterized by lack of hierarchy and pervasive conflicts of interest (Keohane and Nye 1977/2001: chapters 1–3; Keohane and Nye 2000). Where conflicts of interest are not severe and especially where power is concentrated, incentives to cooperate can lead to the construction of robust international regimes, such as the international trade regime built around the General Agreement on Tariffs and Trade and the World Trade Organization (Keohane 1984; Steinberg 2002). But where interests and power are more fragmented, incentives for cooperation often lead to what Kal Raustiala and David Victor have called "regime complexes." In their terms, a regime complex is "an array of partially overlapping and non-hierarchical institutions governing a particular issue area" (Raustiala and Victor 2004; see also Keohane and Victor 2011).

The purpose of this article is to describe the history of the energy regime complex as it has changed over the past 40 years. We interpret this history in light of a very straightforward explanation of the sources of institutional change, which relies on a conception of politics as reflecting the interests of the actors with the greatest relevant resources, and the strategies they employ. Although for simplicity we refer to the "energy regime complex," a more accurate (but cumbersome) phrase would be the "oil-energy regime complex," since our principal focus is on oil, which is by far the most important internationally traded source of energy. However, other energy issues are implicated, since petroleum markets and organizations are closely linked to other energy sources as well, so we retain the broader rubric. We do not develop a novel general theory nor do we engage in hypothesis-testing. We do engage in theory-guided historical analysis, in which our interpretation of changes in the energy regime complex is structured by a more general understanding of how institutions change in world politics.[1] The advantage of such a disciplined interpretive case study is that, by applying known theories to a new terrain, it forces one to sharpen these theoretical perspectives and it may generate new suggestions for improving the theory (Odell 2001).

One of the principal contributions of our historical interpretation of the energy regime complex is to highlight a pattern of punctuated equilibrium in institutional innovation. A pattern of punctuated equilibrium is characterized both by periods of no significant innovation and periods of great innovation, as opposed to a continuous, gradual process of change. This is a pattern that Stephen D. Krasner described some time ago, borrowing the concept from paleontologist Stephen J. Gould (Krasner 1984). The concept of punctuated equilibrium has been applied to various aspects of international politics, but to our knowledge, this article is the first to adapt it for the study of international regime complexes. Other works have applied the notion of punctuated equilibrium to environmental regimes (Young 2010), international norms (Goertz 2003), and international law (Diehl and Ku 2010). Unlike the evolutionary record studied by Professor Gould, the pattern of punctuated equilibrium in energy involves a relatively balanced pattern of stasis and innovation, rather than very long periods of stasis with much shorter bursts of innovation. In this article, we show that dissatisfaction is a necessary condition for innovation.

[1] For a penetrating discussion of related issues in theory-development, see Eckstein (1975). For a systematic discussion of change in formal international organizations, see Shanks et al. (1996).

Innovation comes not from a broad consensus on technical improvements but as a result of dissatisfaction on the part of a sufficiently large coalition of states.

Our second major point is that change is path-dependent, involving incremental changes in existing institutions, only when the interests of the major dissatisfied actors (importers or exporters) are homogeneous. When those interests are heterogeneous, no proposals for incremental change in existing institutions command sufficient support, and states seeking major change have to create new institutions.

The heart of our historical analysis is found in the fourth section of the article. The second section briefly sketches our conception—we do not call it a "theory"—of how change in a regime or regime complex takes place. This conception is meant to provide some analytical structure to our historical and institutional account, rather than having been generated independently through either deductive reasoning or induction from other issue-areas (Bates et al. 1998). The third section describes in detail institutional change in the energy regime complex. The fourth section builds on the historical description in the third section to argue that, indeed, the timing of change in the energy regime complex depends on dissatisfaction and shocks, as our interpretive framework claims. Moreover, the fourth section highlights the conditions under which different types of institutional innovation—either path-dependent or *de novo* changes—occurred in the regime complex.

2 Changes In Regime Complexes: An Interpretive Framework

Regimes and regime complexes are subject to change, as new issues arise and configurations of power and interests change (Keohane and Nye 1977/2001: chapters 4–6). Actors are sometimes motivated to seek institutional change, and sometimes these efforts at institutional innovation succeed, generating major changes in the institutional structure of the regime complex. Within such complexes, one can distinguish three main types of institutional innovation: the creation of new organizations and links between organizations; the inclusion in established organizations of major new members with the capacity to shape policy; and internal structural changes, reflecting the adaptation of existing organizations to new conditions (Aggarwal 1998; Young 2002; Helfer 2004; Alter and Meunier 2009).

One way of thinking about institutional change is in terms of the demand for and supply of innovation (Keohane 1982). Demand is created by strong dissatisfaction by policymakers with the outcomes of the regime complex. This dissatisfaction typically stems chiefly from dissatisfaction with the distribution of material benefits that arises from the regime complex, although symbolic issues may sometimes be relevant as well. Unsatisfactory outcomes may be perceived as a result, in part, of ineffective, missing, or inappropriate institutions. As dissatisfaction about outcomes in the issue-area increases, so do opportunities for change in the institutional landscape. Conversely, as the dissatisfaction of a given issue-area decreases, the regime complex is likely to become frozen, retaining the structure that it developed during the previous period.

One natural consequence of strong dissatisfaction is increased demand for policy changes, and sometimes structural changes, within the regime complex. An example of a policy change within a regime complex is a decision by the Organization of

Petroleum-Exporting Countries (OPEC) to supply more oil to global energy markets; an example of change in the institutional structure of the regime complex is the creation of a new institution such as the International Energy Forum. Both become more likely as dissatisfaction with the current state of energy markets increases. Although institutional changes are likely to have more enduring consequences than policy shifts alone, multilateral institutions are hard to change. We therefore expect that major institutional change will typically only occur when dissatisfaction with the status quo is intense.

Our interpretation of dissatisfaction as a driver of changes in regime complexes is consistent with the concept of "satisficing," first developed by Simon (1982). In the simple form of a satisficing model that we employ here, each actor is either satisfied relative to a reference level, or not. If the actor is satisfied, it persists in its status quo behavior; if it is dissatisfied, it may seek to innovate, depending on the costs of doing so. When actors are willing to accept the status quo, institutional innovation is slow or non-existent. Once dissatisfaction grows strong, however, we expect demands for innovation.

Furthermore, much depends on who is dissatisfied. It may not matter if weak actors are unhappy with the situation. But the structure of a regime complex is likely to change when powerful actors desire a change in the status quo outcome that is being blocked by the current institutional landscape: that is, when the underlying structures of power and interests no longer conform to institutional arrangements. Their dissatisfaction may be generated by changes in the status quo resulting from market forces, the behavior of transnational actors, the actions of other states, or institutional decisions. Before the state-led transformation of oil markets in the 1970s, a discussion of "major actors" in energy would have focused at least as much on the major international oil companies as on states; but since the 1970s, states have played the dominant roles on these issues so we focus on them (Anderson 1981; Yergin 1991). Institutional change may also be stimulated by changes in the power of states as they perceive it, or by changes in the values and ideas of those in power.

Dissatisfaction does not necessarily lead to far-reaching reform. Instead, dissatisfied states may engage in strategic "forum-shopping" or "regime-shifting" in which they choose to operate through particular institutions within the regime complex or shift to other regimes; or they may settle for relatively minor institutional changes (Raustiala and Victor 2004; Helfer 2004; Biermann et al. 2009).

It follows from our satisficing argument that regime complexes, like other institutions, will be "sticky" in the sense that they are hard to change. Constructing a coalition sufficient to impose large institutional changes, or to create major new institutions, is very difficult. As a result, we expect changes in regime complexes to exhibit a pattern of "punctuated equilibrium," driven by sporadic events and dissatisfaction among major states (Krasner 1984). For dissatisfaction to lead to institutional change, groups of powerful actors with similar interests must react to these events in similar ways, creating coalitions that are able to translate their preferences into actions (the supply side of institutional change). If there is no sufficiently large coalition of dissatisfied states in response to environmental changes, institutional inertia will prevent significant change. But if such a coalition of dissatisfied actors forms, major changes can result.

Measuring "dissatisfaction" is difficult. In this paper we focus on oil prices as the chief driver of satisfaction or dissatisfaction. Our premise is that the reference level for actors is set by prices over the previous few years.[2] Exporters will be satisfied if oil prices are above their reference level, and importers will be satisfied if oil prices are below their reference level. Satisfaction may vary within each group, of course. It is well known, for example, that Saudi Arabia and some smaller Gulf producers can withstand much lower oil prices than Iran. On the importer side, countries that are highly import-dependent (like Japan) are more vulnerable to oil supply shocks than countries that are less reliant on foreign oil supplies (like the US). In stable periods, the result will be a price band in which both exporters and importers are satisfied. Table 3, later in this paper, identifies some periods in which both exporters and importers were satisfied, along with periods in which either importers or exporters were dissatisfied. Only in the latter periods do we expect pressure for innovation.

Exporting and importing states always have different preferences from one another, so within the whole set of actors, preferences are always heterogeneous. But within the exporting or importing institutions, the heterogeneity of state preferences is a variable. Here we are interested specifically in states' preferences about the best institutional arrangement in response to a situation about which they are dissatisfied ("solution preferences"). When heterogeneity is low—that is, the preferences of the dissatisfied set of members (importers or exporters) are relatively homogeneous—institutional change is likely to be *path-dependent.* New or adapted institutions will reflect previous institutional arrangements, largely because transaction costs will be reduced by keeping many organizational routines in place. But the preferences of the dissatisfied set of states may be heterogeneous: exporters or importers may be divided. In such a situation, change within the context of the existing institutions will be difficult or impossible, so we expect either inertia or *de novo* innovation involving new institutions with new membership configurations. Thus new institutions are expected to emerge principally when there is a splintering of the membership of an existing institution, which leads to some members striking out on their own.[3] Figure 1 provides a schematic description of our argument.

We also conjecture that regime complexes may be more likely to evolve according to a pattern of punctuated equilibrium than individual regimes. In periods of relative satisfaction among state actors, the interlocking institutional elements of a regime complex reinforce against change. In periods of high dissatisfaction, the addition of a new institution in the regime complex or a major change to existing institutional elements could cause ripple effects that require changes throughout the complex.[4] While we find this logic appealing, we do not seek to test this conjecture in this paper, in part because we are only looking at a single regime complex. In the conclusion of the paper, we suggest how our approach might further comparative analysis in the future.

[2] This definition is intentionally imprecise. We caution against an overly precise definition of the reference level for satisfaction, as it is necessarily shaped by context and circumstances.

[3] It is also possible that an institution could be created when there is no relevant existing institution at all, but given the large number and breadth of international organizations, we expect this to be very rare.

[4] We are indebted to an anonymous reviewer for pointing this out.

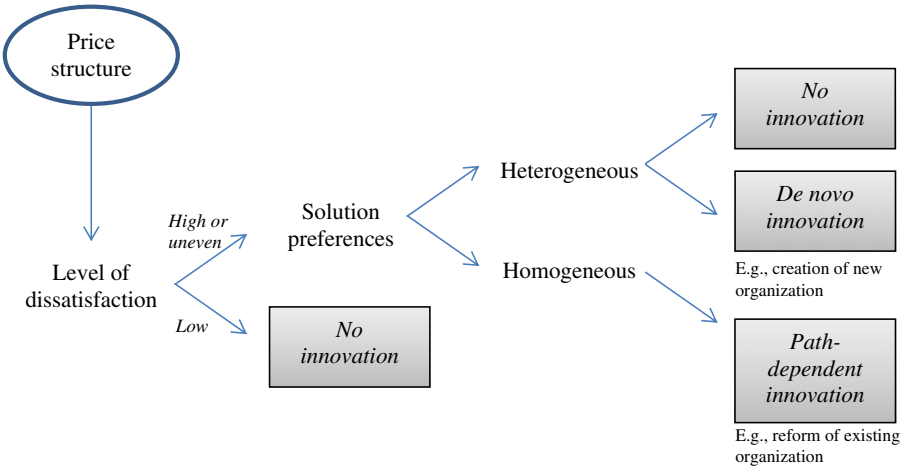

Fig. 1 Theoretical schematic of institutional innovation

3 Institutional Change in the Energy Regime Complex, 1950–2010

In this section we explore the implications of the argument sketched above by examining the regime complex that developed first around international trade in oil, by far the most important internationally traded source of energy. Recently, some related institutions dealing with other energy sources have been created, which we include in our scope. We focus on the formal organizations that operate in the energy regime complex, specifically on the most important intergovernmental organizations with an energy-specific mandate and on the G7/G8, which coordinates some important dimensions of international energy cooperation at the level of heads of government. This way, the focus is narrowed to exclude non-governmental and industry organizations (e.g., the World Energy Council), regional organizations (e.g., the EU), and international organizations that sometimes deploy energy-related activities to attain non-energy goals (e.g., the World Bank and its efforts to liberalize the energy sectors in developing countries to promote development). The international trade regime, the nuclear safety regime, the multilateral development banks, and informal governance networks are not central to the regime complex as we define it here, even though they clearly affect it.[5]

Our empirical method is to trace how the international energy regime complex has emerged and changed in the postwar period. To that end, we take a snapshot of the regime complex for every fifteen-year period from 1950 and examine changes between the periods. Examining the same regime complex over time enables us, in effect, to control for numerous variables specific to the issue-area and actors involved (Thompson 2010). We are interested in institutional innovation defined as significant organizational changes. As noted above, such changes fall into three categories: 1) the creation of new organizations and links between organizations; 2)

[5] For a more comprehensive mapping of the energy regime complex, see Colgan (2010); Lesage et al. (2010); Goldthau and Witte (2010). See also Florini and Sovacool (2011) for a recent overview of some of the major issues in global energy governance, and the connections among them.

the inclusion of major new members—that is, members with the potential to reshape the organization; and 3) major internal structural changes, such as new operational units or significant changes in voting weights. The advantage of this approach is that organizational changes are relatively easy to observe and thus provide a convenient metric to measure institutional innovation in the regime complex.

In the late 20th century there was a fragmented and poorly coordinated set of energy-related organizations, including OPEC and the International Energy Agency (IEA). Most of the industrialized democracies of Western Europe, North America, and Asia-Pacific, are members of the IEA, and these states also address energy issues in the Organization for Economic Cooperation and Development (OECD) and in the Group of Seven (G7, later the G8). Two regional energy organizations exist, the Latin American Energy Organization (known as OLADE, its Spanish acronym) and the African Energy Commission (AFREC).[6] Truly global institutions devoted to energy issues developed only relatively recently, such as the International Energy Forum (IEF), which includes both consumers and producers of energy and petroleum.

3.1 1950–1965

Until the early 1970s there was almost no structured international energy cooperation among the major energy consuming nations. Only in the area of nuclear energy was there a multilateral institution: the International Atomic Energy Agency (IAEA), established in Vienna in 1957. The establishment of the IAEA grew as much out of fear of an atomic arms race as out of enthusiasm for this new source of power.[7]

The lack of sustained multilateral energy cooperation before the 1970s reflected the fact that until the recovery from World War II, almost all of the energy consumed in the developed countries was produced within their borders (Victor et al. 2006; Smil 2005: 15). Since most industrialized countries were endowed with large indigenous coal reserves, there was little international trade in coal, and thus no need for international regulation.[8] Although between 1950 and 1970 Europe changed from a coal-based economy toward one based on petroleum imports from the Middle East, the principal oil consumers, grouped together in the OECD, saw no need for a separate energy organization. On oil, the OECD adopted two legislative measures applicable only to the European member countries of the organization. These measures, dealt with stockpiling and oil apportionment in an allocation (Scott 1977).[9]

The United States was by far the world's largest oil producer and in 1970, it still produced 85% of the oil it consumed. Indeed, the United States maintained

[6] There is also an APEC-Energy Working Group to foster energy dialogue in the Asia-Pacific region, but it is not a formal, independent organization.

[7] See, for example, President Eisenhower's *Atoms for Peace* speech. Available from: http://www.iaea.org/About/history_speech.html. Accessed 11 March 2010.

[8] An interesting exception is the European Coal Organization (ECO), founded in 1945 to allocate available coal supplies to needy member states. Although the ECO was regarded as quite effective, it was disbanded in 1947 by a unanimous decision of its member states.

[9] The measures were carried over from the OECD's predecessor, the Organization for European Economic Cooperation.

mandatory oil import quotas until 1973 (Bohi and Russell 1978). State regulatory authorities within the United States, most notably the Texas Railroad Commission, enacted policies to restrain production and maintain prices. Meanwhile, the international oil trade was dominated by a small group of oil companies, which were of exclusively American and Western European origin. For 25 years after World War II this oligopolistic market structure was remarkably stable.[10]

The situation began to change in 1960, when the Organization of Petroleum Exporting Countries (OPEC) was founded at the initiative of Venezuela and Saudi Arabia. Those two countries sought to emulate the pro-rationing policies of the Texas Railroad Commission, but in face of opposition from the other founding members—Iran, Iraq, and Kuwait—OPEC was initially formed not as a cartel but as a vehicle to reduce dependence on the international oil companies by discussing royalties and taxes (Yergin 1991: 523).

3.2 1965–1980

OPEC's five original members were soon joined by other oil-exporting states, mainly from the Middle East and North Africa. By 1973, OPEC had twelve members and was producing 53.9% of total world oil output.[11] More importantly, the oil-exporting countries had succeeded in slowly wresting control of production and prices from the oil majors. The lead was taken by Libya where Colonel Qaddafi, after seizing power in 1969, threatened to expropriate any foreign oil company that did not cut production and pay more taxes. The oil companies reluctantly gave in, and the Libyan example was followed by other oil-producing states, all claiming a larger share of the companies' profits. After a while, the companies united in a common front and sought to negotiate with OPEC as a bloc. This resulted in the 1971 Tehran and Tripoli Agreements, which increased royalties and prices. Simultaneously, there was a wave of nationalizations in the oil industry, including Libya (1970), Iraq (1972), and Venezuela (1974), which led to the present era in which national oil companies control the majority of the world's oil reserves. These developments signaled a shift in the distribution of power in the international oil market away from the majors toward the OPEC countries.

OPEC's takeover of production and pricing policies occurred in the context of a tightening international oil market. Due to high economic growth in the industrial world, demand was catching up with available supply, and the OECD countries became increasingly dependent on oil imports from the Middle East. At the same time, dramatic changes took place in the US domestic oil industry. US oil production peaked in 1970 and one year later, following the introduction of domestic price controls by Nixon to curb rising inflation, the Texas Railroad Commission allowed all-out production for the first time in a quarter century. The new price control regime and the loss of spare capacity effectively deprived the United States of its ability to influence world oil prices (Morse 1999). These new market circumstances

[10] The Soviet Union and its allies were outside this system, being essentially self-sufficient in oil.

[11] OPEC Annual Statistical Bulletin, available through http://www.opec.org. The following countries joined OPEC in the 1960s–1970s: Qatar (1961), Indonesia (1962), Libya (1962), the United Arab Emirates (1967), Algeria (1969), Nigeria (1971), Ecuador (1973), and Gabon (1975).

set the stage for oil-exporting countries to discover the political utility of the "oil weapon."

The oil shock of 1973–74 would fundamentally reshape the global oil market. The pro-Israeli position of the United States and the Netherlands in the Yom Kippur War of October 1973 prompted OAPEC to impose oil embargoes on those two countries. OAPEC was created in 1968 by the three (then) most moderate Arab oil producers—Kuwait, Saudi Arabia, and Libya. In just a few years, however, as OAPEC's membership had expanded, the mood within OAPEC had shifted dramatically, paving the way for the 1973 oil boycott and production cuts. The net result was a drop in oil supplies of about 9% on a global scale between October and December 1973 (Yergin 1991). The major oil-consuming countries reacted to this crisis in an uncoordinated and competitive manner. Some pressured their oil companies into giving them a preferential treatment. Others imposed restrictions on the export of petroleum. Larger countries' companies bid up oil prices on the spot market. Some European countries sought to distance themselves from the Dutch and appease the Arabs.

Faced with this challenge, the United States sought to create a new organization. Initially, Secretary of State Henry Kissinger intended to set up an explicitly anti-OPEC organization, but the European states and Japan, which were more vulnerable to oil supply interruptions than the United States, successfully resisted this call (Katz 1981). By November 1974 agreement was reached on the International Energy Program (IEP), establishing the IEA, with 16 members, as an autonomous agency of the OECD. The IEA's secretariat was housed in Paris, but ironically France did not join the IEA because it preferred to maintain good relations with the Arab countries.

The IEA has two principal functions. The first and most important is to maintain and improve systems for coping with oil supply disruptions. Since its inception, the IEA has required its member countries to maintain a petroleum reserve equivalent to its consumption of net oil imports for a certain period of time. Initially set at 60 days of imports, the reserve requirement was soon increased to 90 days, where it has remained for more than 30 years. In case of an international disruption to oil supply, the IEA is empowered to cope in a variety of ways with supply disruptions. The organization also requires major oil companies to share information, including proprietary and classified data. The second key function of the IEA is to act as a body for the development of policy, information sharing, and technology transfer. During the long periods of oil-market stability, this second function has been the principal activity of the IEA (Van de Graaf and Lesage 2009).

A year before the IEA was created, in November 1973, the Latin American countries established their own continent-wide energy organization, namely the Latin American Energy Organization (OLADE). Although OLADE was created in the fall of 1973, it was not a direct response to the embargo; talks had been ongoing for months. It was designed to contribute to the region's energy integration, conservation, and protection, although in practice its achievements have been modest.

The turbulent 1970s also spawned another new relevant institution, the Group of Seven (G7). Alarmed by the international monetary and energy crises of the early 1970s, the leaders of six major industrialized countries started to convene regularly, first as the G6 in 1975, then as the G7 with the addition of Canada in 1976, and then

as the G8 after the addition of Russia in 1997. Although the agenda of the G7/G8 has always concentrated primarily on macroeconomic issues, it has also addressed energy issues from the outset. The G7/G8 has a patchy record on energy, since its attention to the subject has waxed and waned, largely tracking oil price fluctuations.

3.3 1980–1995

As a result of the two price hikes of the 1970s, consumer countries shifted away from oil and new oil producers emerged outside of OPEC, thus lowering the demand for OPEC's oil. The decontrol of oil prices in the United States between 1979 and 1981 was particularly important in this regard (Ikenberry 1988). As official oil prices began to fall and OPEC started to lose market share, OPEC members agreed on oil production quotas in 1982 and again in 1983. This was actually the first occasion since its inception that OPEC tried to operate as a cartel. Moreover, OPEC also established two new bodies—the Market Monitoring Committee in 1982 and the Ministerial Executive Council in 1984—to monitor the compliance of individual member countries with the production quotas (Claes 2001). For a moment this system seemed to work, but it only did so because the costs were borne almost entirely by Saudi Arabia. Numerous member countries exceeded their quota at the expense of Saudi Arabia. Further institutional innovation was made difficult by the fact that two of OPEC's most important producers, Iran and Iraq, were at war. Riyadh's patience was soon exhausted and it decided to flood the market with oil, leading to the collapse of oil prices in 1986 (Parra 2010).

The IEA underwent several changes during this period. First, the membership grew to become virtually OECD-wide, of which the accession of France to the agency in 1992 was the most important.[12] The IEA also changed the way in which it dealt with oil supply disruptions. Soon after its creation it became apparent that the threshold required to activate its allocation system—a collective or national oil supply disruption of at least seven percent—was too restrictive. Thus, in 1984, the IEA's Governing Board established a new consultation procedure, the so-called coordinated emergency response measures (CERM). Under CERM, a coordinated release of oil stocks to the market becomes possible even when the supply shortfall is less than 7%. Releasing oil stocks has thus come to be preferred over oil sharing, reflecting the members' preference for market-based regulation. A third change in the IEA was a broadening of the agency's purposes and functional scope. In 1993, the Governing Board adopted the so-called Shared Goals, which have come to be known as the "three E's:" energy security, economic development and environmental protection. Compared with the provisions of the IEP Agreement of 1974, the Shared Goals dedicate much more attention to free trade and to the environment, while the document contains fewer references to nuclear energy (Van de Graaf and Lesage 2009).

Despite these changes, in some ways the IEA remained structurally frozen in time. Indeed, the five principal divisions of the IEA's organization in 2010 were the same (with some slight name changes) as they were in the early

[12] Anno 2011, only six OECD countries have not joined the IEA, either because they do not want to—as is the case with Iceland and Mexico—or because they have only recently joined the OECD—as is the case with Chile, Estonia, Slovenia and Israel, which have all joined the OECD in the course of 2010.

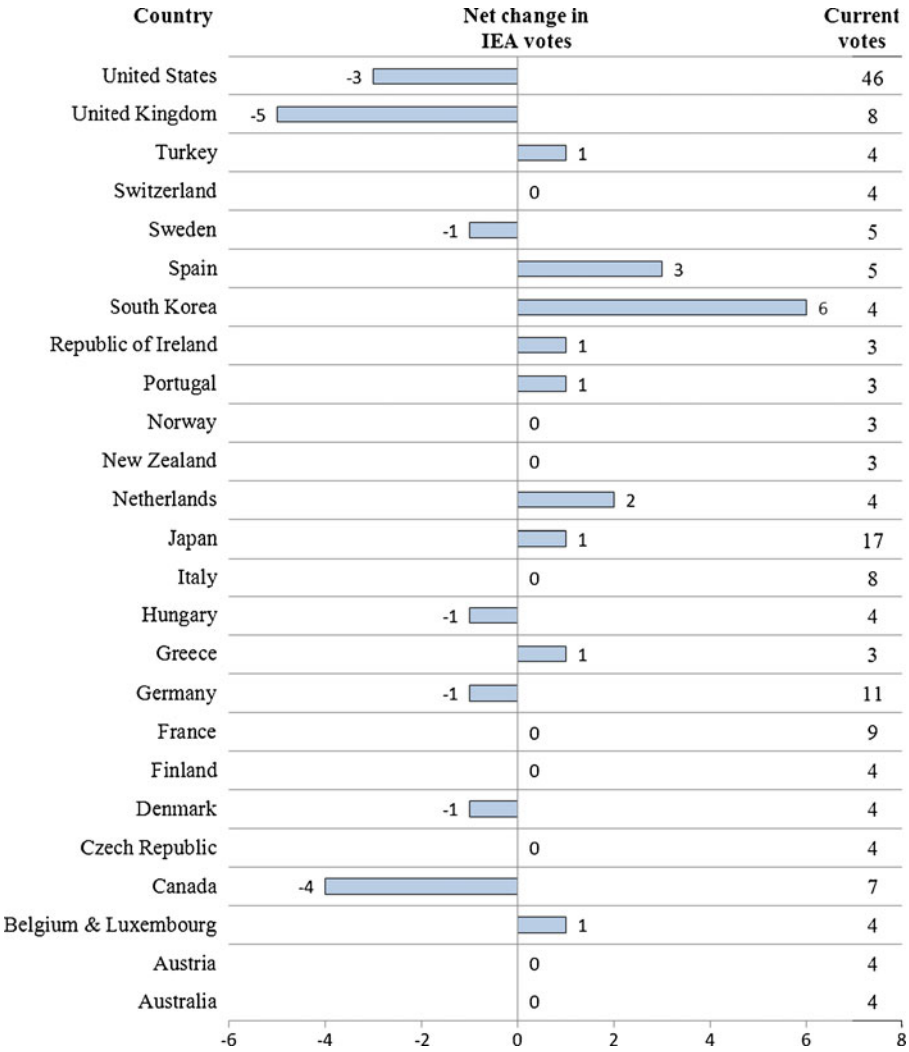

Fig. 2 Net change in IEA Votes, if based on 2005 net oil imports

1980s.[13] The rigidity of the IEA structure is indicated by the voting structure of its Governing Board. Decisions at the IEA are typically made by consensus, but in the event of an energy crisis in which difficult oil supply allocation decisions must be made, voting could become critically important. However, the votes on the Board are distributed according to an arcane system based in large part on the 1973 net oil imports of the member countries. In the 1990s, there were multiple efforts to find a way to redistribute the IEA's votes, all were defeated (Bamberger 2004: 29). Since powerful states benefited from the existing regime, there was little incentive for them to support a reform. Figure 2 shows the difference in votes each country would

[13] In 2010, the five divisions were known as: the Executive Office, Oil Markets and Emergency Preparedness, Energy Technology and R&D, Long-term Cooperation and Policy Analysis, and the Global Energy Dialogue.

receive if the voting structure were modified to reflect the net oil imports in 2005.[14] While South Korea and Spain stand to benefit significantly, the United States, the United Kingdom, and Canada would all lose a large number of votes. The rigidity in the IEA's voting structure is emblematic of the overall stability in its organizational structure and core rules and procedures since the 1970s.

Outside of the IEA, two new multilateral energy initiatives were launched in the early 1990s. First, there was the International Energy Forum (IEF), a biannual dialogue between energy consumers and producers. The IEF has its roots in the inaugural "ministerial seminar" of producers and consumers held in Paris in 1991, at the initiative of France and Venezuela. Gradually, the IEF process has moved along the path of institutionalization, with the establishment of a permanent secretariat in Riyadh in 2003 and a concomitant International Energy Business Forum in 2004. Saudi Arabia wanted to finance a permanent secretariat, because the IEF provided it with political cover to take a more moderate position within OPEC.[15]

The IEF is one of the most inclusive global energy forums. More than 80 countries participate, including all IEA and OPEC members. The IEF also gives a voice to important producing countries outside of OPEC, such as Russia, Brazil and Mexico, as well as key importing countries outside the IEA, such as India, China and South Africa, and many other countries from the developing world. One area in which the IEF has successfully made progress is oil data transparency. In 2000, the IEF secretariat brought together the five other key international organizations involved in oil statistics to construct what was called the Joint Oil Data Initiative (JODI) to increase the quality of data.

A second new institution that emerged in this period was the Energy Charter Treaty (ECT). The roots of the ECT date back to the post-Cold War euphoria of the early 1990s. Many successor states to the Soviet Union, including Russia, sought investments to exploit their energy resources. Western European countries, on the other hand, sought to diversify their sources of energy supply to diminish their dependence on the Middle East. The European Energy Charter, a political declaration stating the intent to promote East–West energy trade, was signed in December 1991, and the Energy Charter Treaty, which is a legally binding multilateral treaty, was signed in 1994. It came into force in 1998 and now includes 51 Eurasian countries (plus the European Communities). The ECT covers a wide range of aspects of energy cooperation: trade, investment, transit, energy efficiency and dispute settlement.

3.4 1995–2010

Since the turn of the millennium, oil and gas markets have been quite turbulent. In this climate of rapid change, two new multilateral energy institutions were created. A treaty establishing the International Renewable Energy Agency (IRENA) officially entered into force in July 2010, signed to date by 149 countries plus the EU and ratified by 65 countries. IRENA has an Assembly, a Council and a Secretariat, which

[14] Poland and Slovakia, which did not join the IEA until 2008, are omitted from this figure.
[15] Interview with William C. Ramsay, former deputy director of the International Energy Agency, Brussels, May 6, 2010.

is located in Abu Dhabi. IRENA performs some soft coordinating functions in the field of renewable energy. It gathers and disseminates knowledge, provides policy advice, and promotes technology transfer and research.

The second institutional newcomer is the International Partnership on Energy Efficiency Cooperation (IPEEC). The decision to establish IPEEC was taken at the G8 Energy Ministerial in June 2008 by the G8 countries plus China, India, South Korea and the EU. Brazil and Mexico later joined the initiative. The ministers explicitly stated that IPEEC is not about developing standards or efficiency goals for the participants, but about the exchange of information and best practices, joint research and development, and developing public-private partnerships. The Partnership, whose secretariat is hosted at the IEA in Paris, is a high-level international body open to all interested countries.

Meanwhile, the IEA was slowly shifting its attention to climate change and engagement with non-member countries. Beginning in 1994, the IEA, together with the OECD, provided a Secretariat for the Annex I Expert Group of the United Nations Framework Convention on Climate Change (UNFCCC). The IEA also hosted the secretariat of the new Climate Technology Initiative (CTI), from 1996 to 2002, after which it was transformed into an IEA Implementing Agreement. The IEA also stepped up its outreach policy in the latter half of the 1990s, concluding cooperation agreements with three priority countries—Russia, China and India (Bamberger 2004). Both the IEA's climate and outreach policies received a significant boost from the 2005 Gleneagles summit of the G8, where the IEA was explicitly invited for the first time to contribute to the G8's climate and energy discussions. Since 2005, the IEA's Executive Director has been invited to five consecutive G8 summits. Today, climate issues have moved to the IEA's mainstream and the agency's Executive Director Nobuo Tanaka explicitly favors full-fledged accession of China and India into the IEA (IEA 2007).

The Energy Charter Treaty, however, did not fare well in this period. It had little impact on investment flows and on reducing transit risk (Victor et al. 2006: 30), nor was it able to prevent or mediate disputes such as the 2006 and 2009 Russian-Ukrainian gas crises. The United States always had reservations (Fox 1996) and despite the fact that Russia would have been an essential member, it abstained from ratification. Thus the ECT violated "the first rule of effective institution building: it alienated the most important player" (Victor and Yueh 2010: 67). Although for a while Russia applied the ECT on a provisional basis, in October 2009 Moscow formally withdrew from the treaty, fearing that former shareholders of Yukos would use the ECT to sue it for its appropriation of their investment. To many observers, this was the final blow to the ECT,[16] although its member countries have created a Strategy Group with a mandate to try to revitalize the Treaty.[17]

3.5 Summarizing the Observed Patterns of Change

The patterns of change that we observe are summarized in Figure 3. This figure graphically depicts the main institutional changes in the regime complex for each

[16] Interview with Claude Mandil, former Executive Director of the IEA, Paris, 9 March 2010.
[17] Source: http://www.encharter.org/index.php?id=21&id_article=205&L=0. Accessed 6 May 2009.

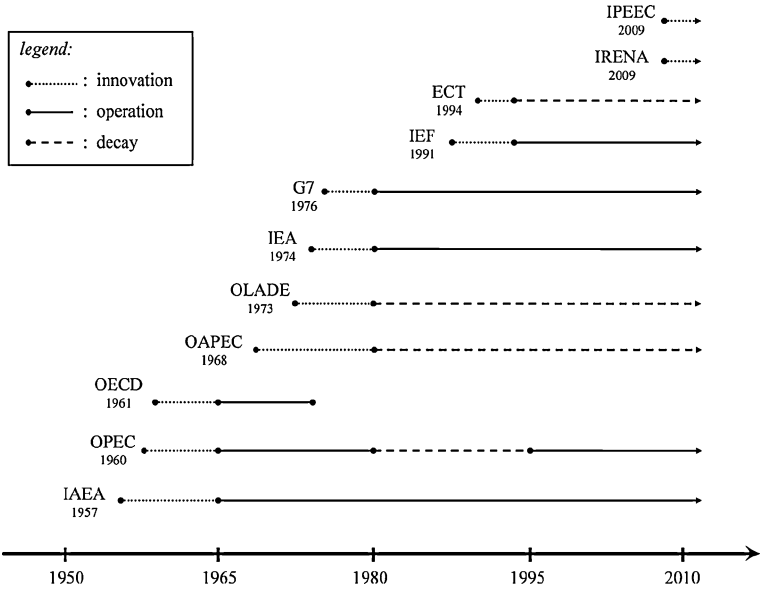

Fig. 3 Institutional changes in the energy regime complex by period

time period. It provides an overall view, although these institutions vary greatly in importance, with the IEA and OPEC being the most important institutions specifically devoted to oil and the G7/G8 being the most important institution overall.

Two additional remarks are in order, one pertaining to the relevance of the surveyed institutions and one about omitted institutions and linkages. First, it should be mentioned that all of these organizations have troubles in affecting behavior in a meaningful way. OPEC is notorious for its member states' cheating on their oil-production quotas and the IEA secretariat has refrained from using its authority to activate the formal oil-sharing mechanisms in previous emergencies. What is more, some of the energy organizations are essentially conceived for symbolic reasons, not as mechanisms for getting things done. The IEF was created in part to get people to stop talking about the need for an organization that spans producers and consumers. To date, IRENA serves mainly as a signal of participating governments that they take climate change serious. Its tiny budget, vaguely stated functions, and consensus-based decision-making will probably prevent it from playing a strong role in global energy and climate politics. The ECT has been almost completely ineffective with regard to the original problem for which it was created—i.e., governing Russian gas exports.

Second, the institutions depicted in Figure 3 are, as explained earlier, only a fraction of a broader energy regime complex. At a minimum, discussions of this broader complex could expand the scope to include 1) the set of rules designed to promote nuclear safety; 2) regional institutions such as the EU, which has been a potent force behind European electricity and gas market integration; 3) the large and growing body of rules to manage energy-related environmental externalities such as the Kyoto Protocol, carbon-trading schemes, or the International Convention for the Prevention of Pollution by Ships (MARPOL), which regulates oil pollution at sea; 4) the rules pertaining to domestic resource governance such as the Extractive Industries Transparency Initiative (EITI) or the G20 action against fossil-fuel

subsidies; and 5) the relevant regulations of the global trade, investment and intellectual property regimes. It is important to keep in mind that there are linkages between these regimes and the organizations that we have surveyed. Needless to say, no single account can do justice to the multiplicity of rules and institutions that make up the full energy regime complex.

4 State Preferences and Institutional Innovation in the Energy Regime Complex

Since our interpretation of institutional change focuses on dissatisfaction by major states we focus first on some measures of which states were important, then on measures of dissatisfaction by major states. We think of the "major states" as the five largest oil importers and exporters in each period, as identified in Table 1. In our analysis, dissatisfaction among at least a subset of these states is a precondition for institutional change.

Our basic measure of dissatisfaction focuses on the price of oil, both its level and its direction and rate of change. Importing states are dissatisfied when oil prices rise sharply or stay very high; exporting states are dissatisfied when oil prices fall sharply or stay very low. As we noted earlier, our premise is that dissatisfaction is shaped by prices over the previous few years, meaning that there is change over time in what constitutes acceptable prices. Table 4, in the Appendix, provides data on OPEC oil revenue from 1975 to 2009, as indicators of dissatisfaction among exporters. Building on these data, Figure 4 displays the change in OPEC's oil revenues compared with the previous 3 years (setting the baseline for a given set of policymakers). Consistent with our satisficing model, we expect there to be innovation only when dissatisfaction is intense, that is, when the revenue loss is substantial (more than 20%). The three periods of high OPEC dissatisfaction are marked with shaded bars: first, during the mid-1980s, reaching a peak in 1986 when

Table 1 Major states affecting the energy regime complex

Oil importers				
1965–1973	*1974–1981*	*1982–1990*	*1991–2002*	*2003–2010*
United States	United States	United States	United States	United States
Japan	Japan	Japan	Japan	Japan
France	France	France	France	China
Germany	Germany	Germany	Germany	France
United Kingdom	Italy	Italy	Italy	Germany
Oil exporters				
1965–1973	*1974–1981*	*1982–1990*	*1991–2002*	*2003–2010*
Venezuela	Saudi Arabia	Saudi Arabia	Saudi Arabia	Saudi Arabia
Iran	Iran	USSR	Russia	Russia
Saudi Arabia	USSR	Venezuela	Venezuela	Iran
Kuwait	Kuwait	Iraq	Iran	Norway
USSR	Venezuela	Iran	Norway	UAE

BP, *Statistical Review of World Energy*, available through: www.bp.com

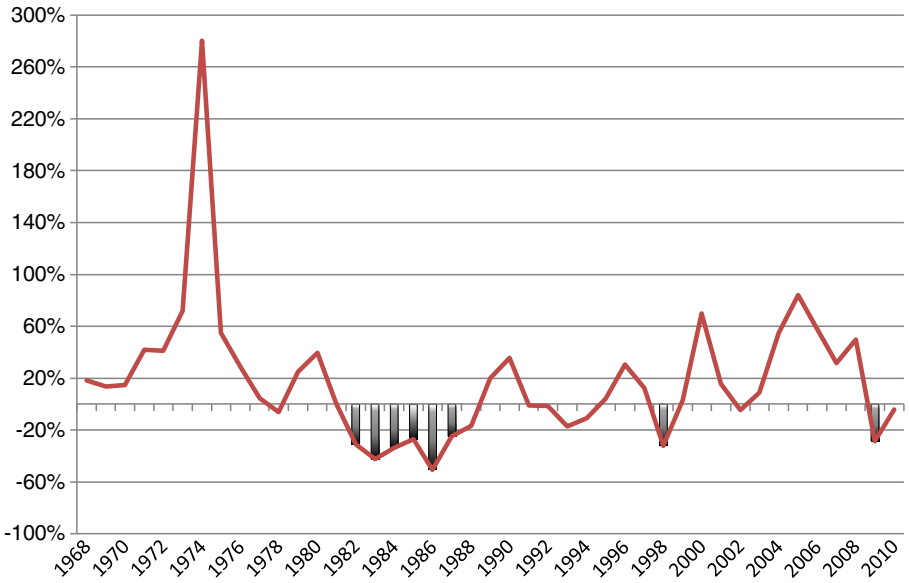

Fig. 4 Change in OPEC oil revenues compared with average of previous 3 years

oil revenues fell sharply; and then, in 1998 and again in 2010, when oil prices plunged dramatically before recovering fairly swiftly.

Table 2 provides a rough measure of collective dissatisfaction on the part of importing states: the extent to which members of the G7 have made new commitments on energy issues.[18] The G7/G8 has met annually for the last 35 years with a varying agenda, not specifically related to energy. Commitments imply efforts to change the *status quo,* requiring time and political attention, implying less attention for other issue-areas. By focusing on the number of commitments on energy issues made at the G7/G8 meetings, we can generate a measure of the degree of attention paid to energy by the leaders of the major industrialized countries, giving us an intermediate indicator of dissatisfaction, lying between oil prices and institutional outcomes (the point marked "Level of Dissatisfaction" in Figure 1). We count the number of commitments each year and then, to smooth out the annual variations, combine them for overlapping 3-year periods (1978–1980, 1979–1981, etc.).

Table 2 documents new energy commitments by the G7/G8, which are high in 1978–81 and 2002–2009, also suggesting high dissatisfaction during those years. Our argument implies that importing countries should press for institutional innovation when they are dissatisfied, and likewise for exporting countries. Table 3 evaluates the evidence for this argument by summarizing the expected and actual extent of institutional innovation over the period 1965–2010. The time periods are identified in the first column, while the second column summarizes the period's oil prices and mentions any major trigger events of that period. When oil prices are moderate—that is, roughly $25–45 in constant 2010 US dollars—we expect there to

[18] The G7 has always been principally a set of oil-importing states, although this balance was shifted somewhat when it became the G8, including Russia. We focus on G7 activity as a measure of dissatisfaction by oil-importing states.

Table 2 Energy Commitments by the G7/G8, 1975–2009

Year	Energy commitments	Description and interpretation
1975	3	
1976	1	
1977	5	
1978	17	*Phase 1: high attention (1978-1981)* Each three-year period between 1978 and 1981 has an average of more than ten commitments per year. Energy is on the agenda of each summit over this period and the group agrees on some remarkably far-reaching commitments. At the 1978 Bonn summit, for example, the United States pledges to let its domestic oil prices rise to world levels. One year later, at the 1979 Tokyo summit, the seven countries even agree to put a ceiling on their oil imports by 1985 and to let a high-level group do periodic reviews of the results.
1979	23	
1980	25	
1981	9	
1982	1	*Phase 2: low attention (1982-1990)* In this period, the annual number of commitments per three year period never exceeds one. At the 1982 Versailles summit there are transatlantic tensions over the European participation in a Soviet gas pipeline project. During most of the 1980s, the G7 remains silent on energy.
1983	2	
1984	0	
1985	0	
1986	1	
1987	0	
1988	0	
1989	1	
1990	1	
1991	12	*Phase 3: moderate attention (1991-2001).* In this period, the annual number of commitments per three year period ranges between 5 and 10. The G7 works especially on nuclear safety in the former Soviet bloc, which was a G7 priority from 1992 to 1996. On other issues, the group has more difficulties in finding common ground. An illustrative example is the G8 Renewable Energy Task Force, which was set up at the 2000 Okinawa summit but whose report was largely ignored by the 2001 Genoa summit due to resistance by the new Bush administration in the United States.
1992	16	
1993	1	
1994	10	
1995	3	
1996	7	
1997	12	
1998	8	
1999	4	
2000	7	
2001	2	
2002	25	*Phase 4: high attention (2002-2009)* The G8 turns to energy again, with an average of almost 40 commitments per year. The 2005 Gleneagles summit is a milestone. It results in a detailed plan of action on energy and climate that contains numerous commitments, delegates tasks to international organizations, and sets up energy dialogues with large developing countries. At the 2006 St. Petersburg summit, the G8 agree to a set of "global energy security principles" which all countries should abide by. In 2009, the G8 creates a new international organization for energy efficiency, the IPEEC.
2003	40	
2004	15	
2005	77	
2006	108	
2007	55	
2008	60	
2009	38	

This table only comprises the energy-related commitments made at the annual G7/G8 summits, not at the ministerial meetings. The figures are based on data from the website of the G8 Research Group at the University of Toronto, available from: http://www.g7.utoronto.ca/. Accessed 12 June 2010

be relatively little dissatisfaction, and thus little innovation in the regime complex, consistent with Simon's notion of satisficing. During periods of high oil prices (e.g., 1973–81; 2003–2010), we expect to see dissatisfied energy-importing states (identified in the third column) acting to change institutional arrangements to handle contemporary problems. Conversely, in periods of low oil prices (e.g., 1985–86, 1998), we expect to see dissatisfied energy-exporting states acting to change institutional arrangements.

4.1 Dissatisfaction, Shocks and the Timing of Innovation

The evidence presented in Table 3 provides considerable support for our argument. During the years in which oil prices were moderate, there was no innovation. There

Table 3 Dissatisfaction and institutional change in energy politics, 1965–2010

Time period	Oil Prices / Trigger Event	Dissatisfied Major States	Expectation	Actual result	Is the argument supported?
1965–1972	Low	Venezuela, Iran, Saudi Arabia	Exporters innovate	Exporters wrest control of production and pricing from oil majors (Tehran-Tripoli Agreements)	Yes
1973–1981	High	US, Japan, Germany, UK	Importers innovate	Importers innovate: IEA, OLADE created	Yes
1982–1987	Declining/low	Exporters dissatisfied, esp. Saudi Arabia	Exporters innovate	Limited exporters' innovation	No
1988–1990	Moderate	None	No innovation	No innovation	Yes
1991–1994	USSR collapses	Geopolitical trigger: All states re-assess	General innovation and re-alignment	Re-alignment: IEF, ECT created; OECD, IEA get new members	Yes
1995–1998	Low, declining sharply in 1998	Exporters dissatisfied	Exporters innovate	OPEC innovates: production agreement with Russia, others	Yes
1999–2002	Moderate on average	None	No innovation	No innovation	Yes
2003–2010	High, except a short dip from late 2008 to early 2009	US, Japan, France, Germany	Importers innovate	Importers innovate: IPEEC, IRENA created	Yes

was also no innovation by a group of states that was expected to be satisfied (i.e., for importers, when oil prices were low; for exporters, when oil prices were high). These periods of relative stasis in the regime complex are an integral part of the pattern Krasner labeled "punctuated equilibrium." During periods of dissatisfaction triggered by high oil prices or major external shocks, we see oil-importing states creating or reforming institutions within the regime complex. Indeed, the periods of high importing state dissatisfaction, as indicated in Table 2, correspond almost perfectly to the two periods of importer state innovation identified in Table 3: 1973–81 and 2003–10. In the 1970s, when the West was faced with widespread gasoline shortages and high oil prices, we see high dissatisfaction and the creation of the International Energy Agency (IEA). In 1979, as dissatisfaction continued, the IEA was restructured into a form that it then retained for more than 30 years: three major committees were added, and the members' strategic petroleum reserve requirement was set at 90 days of oil importers, where it has stayed ever since. Finally, during the rising oil prices of 2003–2010, energy importers were active in a number of ways, most notably by creating the International Renewable Energy Agency (IRENA) and the International Partnership on Energy Efficiency Cooperation (IPEEC).

Table 3 also shows that energy exporters are likely to innovate when oil prices are very low, as they were in 1998. Weak global demand for oil following the Asian financial crisis of 1997 and excess global oil production capacity combined to lower oil prices to less than $10 per barrel. Many oil exporters faced severe fiscal deficits as a result of the unanticipated drop in revenues. Consequently, OPEC members reinvigorated the organization, agreeing to tighten oil production and more strictly observe their oil quotas. At least as importantly, OPEC also forged a significant agreement with non-OPEC exporters, the most significant of which was Russia, which was also in fiscal crisis (El-Gamal and Jaffe 2010). The resulting reduction in oil production and decreased investment in production capacity, combined with a return in global oil demand, meant that prices rapidly appreciated over the next 3 years, more than doubling by 2000.

Table 3 contains one observation that clearly does *not* fully conform to our expectations: the period in 1982–1987 when oil prices fell dramatically. The falling prices were both a cause and consequence of Saudi Arabia's decision to abandon OPEC quotas and greatly expand its production. In this period, we might have expected institutional innovation by OPEC to retrench its quota system and strengthen its market power in order to stabilize prices, but in fact the innovation was limited. Our conjecture is that more meaningful innovation did not occur in part because two of its most important members, Iraq and Iran, were at war. The organization was therefore disorganized and unable to reach an agreement for institutional change.

The genesis of IRENA is a particularly interesting example of how state dissatisfaction plays a role in the development of the regime complex. The creation of IRENA follows a pattern of policy creation described by Kingdon (1984), in which policy change occurs when three necessary conditions are met: a problem, a solution, and a policy entrepreneur all exist at the same time. The proposed solution—an international agency dedicated to renewable energy—existed for a long time, dating back at least as far as the Brandt Report of 1980 and a UN conference on renewable energy in Nairobi in 1981 (Scheer 2007: 166). A policy entrepreneur emerged in the 1990s: Hermann Scheer, a member of the Social Democratic Party (SPD) in Germany,

who led an active lobby for a renewable energy agency. Scheer chaired two environmental NGOs that championed the idea of such an agency; in 1990, he wrote a "Memorandum for the Establishment of an International Solar Energy Agency (ISEA)"; and in 2002 Scheer managed to get the SPD-Green coalition government program to explicitly include an initiative for the establishment of IRENA (Eurosolar and WCRE 2009). Yet despite the presence of both a policy entrepreneur and a proposed solution, the third element of policy change was missing: the perceived problem, in Kingdon's terms, or dissatisfaction, in our terms. In 2004, an international conference on renewable energy was held by Germany, but the resulting Political Declaration, adopted unanimously by 154 high-level government representatives at the end of the conference, did not mention IRENA even once.[19] Only within the context of dramatically increasing oil prices during 2005–2009, and a significant political lobby by the wind energy manufacturers in Germany, Denmark, and Spain, did the proposal for IRENA finally get traction. Two preparatory conferences were held in Germany in 2008 and IRENA was finally established in January 2009.[20]

4.2 Path-Dependency in Institutional Change

Krasner's notion of punctuated equilibrium built on conceptions of "path dependence" in institutional change, which have been elaborated since then, notably by Pierson (2004). Path dependence implies that institutional changes are constrained by previous organizational and political structures. We argued in the second section that when members of existing institutions with homogeneous preferences press for change, the result is likely to be path-dependent. This condition is met for multilateral energy cooperation among major consuming countries over the period of this study. With the exception of France, the major OECD countries have had similar preferences on energy policy. Similarly, the creation of IPEEC was characterized by a high degree of homogeneity in the preferences of the major OECD players.

Among major oil-consuming countries, there are tight links over time in the "chain" of connections between successive organizations. The origins of this chain can be traced back to the Marshall Plan, which triggered the establishment of the Committee (and later Organization) of European Economic Cooperation, divided into specialist subcommittees including those for coal, oil, and electricity. In 1961, this organization was replaced by the Organization for Economic Cooperation and Development (OECD). When the International Energy Agency (IEA) was created in 1974, it was nested within the OECD's institutional machinery to allow the new agency to become operational almost immediately. As a result, the IEA's membership was, and is, explicitly limited to OECD member countries. The latest addition to the chain was the nesting of the new International Partnership on Energy Efficiency Cooperation (IPEEC) within the IEA in 2009. Crucially, the hegemonic actor among

[19] Declaration available from: http://www.ren21.net/pdf/Political_declaration_final.pdf. Accessed 6 May 2010.

[20] See: www.irena.org. Accessed 6 May 2010. A complementary explanation for the timing of change in the energy regime complex involves the increasing salience of climate change, but in view of the facts that (i) there has been little progress on effective climate change agreements, and (ii) institutional changes in the oil/energy regime complex did not appear until oil prices rose sharply, concern about climate change does not seem to provide a plausible alternative explanation of recent institutional innovation.

energy importers—the United States—favored the development of each step in this chain.

The IEA's institutional trajectory over the past decades is particularly influenced by the choices of the agency's architects back in 1974. All of the important changes that have occurred in the IEA—such as the shift to market-based ways of dealing with oil supply disruptions (the so-called CERM procedure), the growing attention to environmental sustainability, and the enhanced outreach policy—have occurred without a change in the IEA treaty, and even without major changes to the structure of the IEA. The path-dependent nature of the IEA is brought into sharper relief by considering a thought experiment: if the IEA were to be designed, from scratch, in 2011, what would it look like? To effectively manage prices, the IEA depends on being able to move the market through releases from its members' strategic reserves, which have impact in proportion to their size relative to the global market. While in the 1970s all of the major oil importing countries were members of the OECD, in recent years China and India have changed the landscape and increased the size of the global market. For instance, in 1995 China was importing just 0.4 million barrels of oil per day; in 2008, it was importing more than 4.2 million barrels per day—more than France and Italy combined. If the IEA were being designed today, its organizers would certainly solicit the membership of China and India. Indeed, several prominent policymakers have sought to bring China and India into the IEA, though without much success (Colgan 2009). The current membership of the IEA, and its continued institutional links to the OECD, thus offers significant evidence of the path-dependent nature of its creation.

In contrast to this path-dependent pattern of institutional development, the regime complex changes in a quite different way when the preferences and beliefs of the major actors are heterogeneous. Three important examples of this type of development exist: the creation of the International Energy Forum (IEF), the European Charter Treaty (ECT), and the International Renewable Energy Agency (IRENA). The creation of the IEF was strongly opposed by the United States, which saw it as a competitor to the IEA. Yet several important states, including France, Norway, and Venezuela, strongly favored cooperation over issues of information transparency, incentives for investment, and reducing volatility in global prices. These differences in preferences and beliefs gave rise to the creation of the IEF, which sought to take advantage of these potential areas for producer-consumer cooperation. The initial reluctance by the United States was gradually overcome, and the US became a paying supporter of the IEF secretariat more than a decade after the first IEF conference.

The Energy Charter Treaty was also created as a result of heterogeneous preferences and beliefs, but as we have seen, Russia formally withdrew from the Treaty in 2009, and the ECT is increasingly considered irrelevant and neglected.

Finally, the creation of IRENA owes much to heterogeneous preferences and beliefs. Crucially, the political importance of climate change varied across actors—more important among Europeans than among North Americans—leading to heterogeneous preferences. German, Danish and Spanish policy-makers had been dissatisfied with the IEA because they saw it as a lobby for fossil fuels and nuclear energy rather than renewable energy sources.[21] Not coincidentally, some of the most

[21] Interview with German official, Berlin, 6 November 2008.

important wind energy manufacturers are located in these countries, and thus stood to gain economically by the spread of renewable energy technologies. The United States was never in favor of the creation of IRENA but found it politically inexpedient to block it, trusting that it would, when located in Abu Dhabi, remain unimportant.[22]

Thus these three institutional changes—the IEF, the ECT, and IRENA—are all evidence of *de novo* innovation, departing from the existing institutions within the regime complex for energy. Each was created in a context of heterogeneous preferences and beliefs among the major players of existing institutions, making the reform of existing institutions difficult or impossible.

5 Conclusion

It is unlikely that a coherent energy regime will be constructed over the next few decades, since institutional inertia is strong and the preferences of major states diverge. Indeed, differences of view within OPEC have recently become intense and public, with the Saudi oil minister denouncing an OPEC meeting on June 8, 2011, as "one of the worst meetings we have ever had" (*Financial Times*, June 9, 2011, p. 1). Saudi Arabia and its allies, which wanted to increase production quotas, are clearly dissatisfied with a situation in which the majority of members, with little or no excess capacity, block production increases. However, without the kind of broad dissatisfaction among exporters as a group that we expect to appear in times of *low* oil prices, institutional innovation is unlikely. It is possible that a splinter group of dissatisfied exporters could create a new organization designed to complement or compete with OPEC, but that would not follow the historical pattern of innovation by exporters when prices are low. Unilateral action (*i.e.,* increased oil production) by Saudi Arabia is more likely.

On the consumer side, pressures from environmentalists and the interests of the renewable energy industry, particularly in Europe, will converge on attempts to construct environmentally-friendly organizations such as IRENA, although how significant they will become depends on whether they receive support from the United States and other major energy consumers. The interests of current members of the IEA and other large oil importers such as China and India are also likely to diverge from one another (Colgan 2009). In short, the institutional landscape of energy will continue to be that neither of anarchy nor a coherent regime for the issue-area, but of an international regime complex.

We are interested not just in the organizational politics of oil but also in broader issues of institutional innovation. By presenting a theoretically-informed interpretation of institutional change in the international energy regime complex since 1970, this paper seeks to contribute to the eventual development of a sound theory, supported by evidence, of how international regime complexes emerge and change. Analytically, we rely on institutional theory, Herbert Simon's concept of satisficing,

[22] Interview with William C. Ramsay, former deputy director of the International Energy Agency, May 6, 2010.

and Stephen J. Gould's notion of punctuated equilibrium as interpreted by Stephen D. Krasner. The demand for institutional change depends on dissatisfaction, indexed for oil importers by high prices and for oil exporters by low prices and revenues. High levels of dissatisfaction by one set of states or another are a necessary but not sufficient condition for institutional innovation. Our work suggests that the character and degree of institutional change in energy politics depends on the degree of homogeneity of preferences among the key players in the existing institutions. When there has been homogeneity in the interests of major actors, the result has been path-dependent institutional change. When there has been heterogeneity in interests, dissatisfied states have had to create new institutions, without obvious predecessors, because existing rules enable their opponents to block major changes in existing institutions.

As a result of this process, a static, functional analysis is insufficient to account for the membership and practices of international regime complexes and the formal organizations within them. The IEA, for instance, has a very different membership and voting rules than an organization with similar functions, created in recent years, would have had. The inherent difficulties of international institutional innovation ensure that path-dependence is strong. State preferences, reflecting not only the value of effective institutional action but also more specific interests rooted both in international positions and domestic politics, will remain strong determinants of institutional change. So will historical conjunctures, institutionalized at key moments into rules and practices that are difficult to change.

Two further questions could suggest interesting directions for institutional research.[23] First, inertia is not the same across all institutions: some institutions are designed with more flexibility than others, or develop practices of frequent institutional change. The European Union, for instance, has changed its voting rules frequently as it has added new members; by contrast, the veto in the United Nations Security Council has remained intact, and limited to five Permanent Members, for 66 years. As we have seen, the voting arrangements in the IEA have been frozen since its founding. It would be interesting to conduct a comparative analysis, across international organizations, of the flexibility or rigidity of institutional practices.

A second direction of research would compare different patterns of change in regime complexes, depending on how well-integrated they are. In a loosely structured or fragmented regime complex, one set of institutional changes could very well occur without disrupting other institutions in the issue-area. In a tightly linked regime complex, however, it might be difficult to change one institution without affecting others; and by the same token, once pressures were sufficient to generate change in one institution, others would have to adjust accordingly.

We believe that analyzing the energy regime complex casts new light on its patterns of inertia and innovation. More broadly, the concept of regime complexes may prove useful in understanding institutional change in other issue-areas as well, and could eventually provide the basis for a comparative analysis of institutional innovation in international regime complexes.

[23] We are indebted to our two referees, each of whom raised one of these questions.

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Appendix

Table 4 OPEC net oil revenue and trends, 1965–2010

Year	Net oil revenue (bn, in $2010)	Annual % change	Direction
1965	56,47		
1966	59,33	5,06%	Neutral
1967	63,45	6,94%	Neutral
1968	70,67	11,38%	Neutral
1969	73,21	3,59%	Neutral
1970	79,17	8,14%	Neutral
1971	105,37	33,09%	Positive
1972	121,28	15,10%	Neutral
1973	175,1	44,38%	Positive
1974	509,19	190,80%	Positive
1975	416,24	−18,25%	Neutral
1976	473,31	13,71%	Neutral
1977	487,81	3,06%	Neutral
1978	430,29	−11,79%	Neutral
1979	579,97	34,79%	Positive
1980	697,2	20,21%	Positive
1981	568,86	−18,41%	Neutral
1982	423,91	−25,48%	Negative
1983	324,14	−23,54%	Negative
1984	291,54	−10,06%	Neutral
1985	252,69	−13,33%	Neutral
1986	143,23	−43,32%	Negative
1987	172,41	20,37%	Positive
1988	157,26	−8,79%	Neutral
1989	188,95	20,15%	Positive
1990	234,49	24,10%	Positive

Table 4 (continued)

Year	Net oil revenue (bn, in $2010)	Annual % change	Direction
1991	191,68	−18,26%	Neutral
1992	202,06	5,42%	Neutral
1993	173,19	−14,29%	Neutral
1994	168,53	−2,69%	Neutral
1995	188,4	11,79%	Neutral
1996	230,21	22,19%	Positive
1997	219,67	−4,58%	Neutral
1998	144,53	−34,21%	Negative
1999	204,02	41,16%	Positive
2000	322,01	57,83%	Positive
2001	257,92	−19,90%	Neutral
2002	249,28	−3,35%	Neutral
2003	301,08	20,78%	Positive
2004	417,45	38,65%	Positive
2005	593,66	42,21%	Positive
2006	691,1	16,41%	Positive
2007	746,35	7,99%	Neutral
2008	1.015,00	36,00%	Positive
2009	584,78	−42,39%	Negative
2010	750	28,25%	Positive

Real net oil revenue data is in billion US dollars. Percentages are calculated on an annual percentage basis. The median oil revenue is 242 billion dollars. Oil revenues within 20% of the median level (193,58–290,27) are coded as "moderate;" more than 20% below the median as low, and more than 20% above the median as high. Rates of change are coded as "positive" above +20%, neutral between −20 and +20%, and negative below −20%. (The median absolute rate of change is 8.0%.) Source: OPEC Annual Statistical Bulletin, available from: http://www.opec.org/library/Annual%20Statistical%20Bulletin/interactive/2009/FileZ/Main.htm (Accessed 28 February 2011). These OPEC figures have been adjusted for inflation by using data from the website of the US Department of Labor: ftp://ftp.bls.gov/pub/special.requests/cpi/cpiai.txt (Accessed 28 February 2011). Oil revenue figure for 2010 is an estimate from the website of the US Energy Information Administration, available through: http://www.eia.doe.gov/cabs/OPEC_Revenues/Factsheet.html (Accessed 28 February 2011)

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