

Möllering, Guido

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Market constitution analysis: A new framework applied to solar power technology markets

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Guido Möllering

Market Constitution Analysis

A New Framework Applied to Solar Power Technology Markets

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anck Institute
for the Study of Societies

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Max-Planck-Institut für Gesellschaftsforschung, Köln

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Guido Möllering is a researcher at the Max Planck Institute for the Study of Societies. This working paper was written partly during his time as a Visiting Scholar at the Center on Organizational Innovation, Columbia University, New York in March and April 2009.

moellering@mpifg.de

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Max-Planck-Institut für Gesellschaftsforschung

Max Planck Institute for the Study of Societies

Paulstr. 3 | 50676 Cologne | Germany

Tel. +49 221 2767-0

Fax +49 221 2767-555

www.mpiifg.de

info@mpiifg.de

Abstract

This paper outlines an integrative framework for the analysis of market constitution and explores its application to solar power technology markets. These markets are currently still in the making and, therefore, particularly suited to studying constitutive processes and the elements that play a role in them. In applying the framework to the constitution of solar power technology markets in Germany from the mid-1990s, the paper focuses on three examples of how constitutive mechanisms that trigger and drive market constitution processes and shape the constitutive elements of markets operate in distinct but interrelated ways: exploitation of technical inventions, business diversification, and political entrepreneurship. The analysis shows the role of market actors in “making” a market at the same time as these actors evidently become “marketized” by adopting market logic. Markets cannot be taken for granted in the field of solar power technologies or, rather, their actual taken-for-grantedness is one measure of the degree to which their constitution has been achieved.

Zusammenfassung

Der Beitrag stellt einen integrativen Analyserahmen für die Entstehung und Entwicklung von Märkten vor und wendet ihn explorativ auf Solartechnologiemärkte an. Da diese Märkte aktuell noch im Entstehen sind, eignen sie sich besonders für die Untersuchung konstitutiver Prozesse und der ihnen zugrunde liegenden Elemente. In der Anwendung des Analyserahmens auf Solartechnologiemärkte in Deutschland ab Mitte der 1990er-Jahre liegt der Schwerpunkt auf drei Beispielen dafür, wie verschiedene konstitutive Mechanismen den Marktentstehungsprozess auslösen und antreiben, dabei nicht nur getrennt wirken, sondern auch zusammenspielen und somit insgesamt die konstitutiven Marktelemente formen. Die Beispiele beziehen sich auf die Nutzung technischer Erfindungen, Geschäftsbereichsdiversifizierung und politisches Unternehmertum. Die Analyse zeigt, welche Rolle Marktakteure bei der Erschaffung eines Marktes spielen, während sie selbst zugleich durch die Übernahme der Marktlogik „vermarktet“ werden. Märkte sind im Feld der Solartechnologie keine Selbstverständlichkeit. Vielmehr kann man an dem Grad, zu dem sie selbstverständlich geworden sind, ablesen, wie weit die Etablierung des Marktes schon erreicht wurde.

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1 Introduction

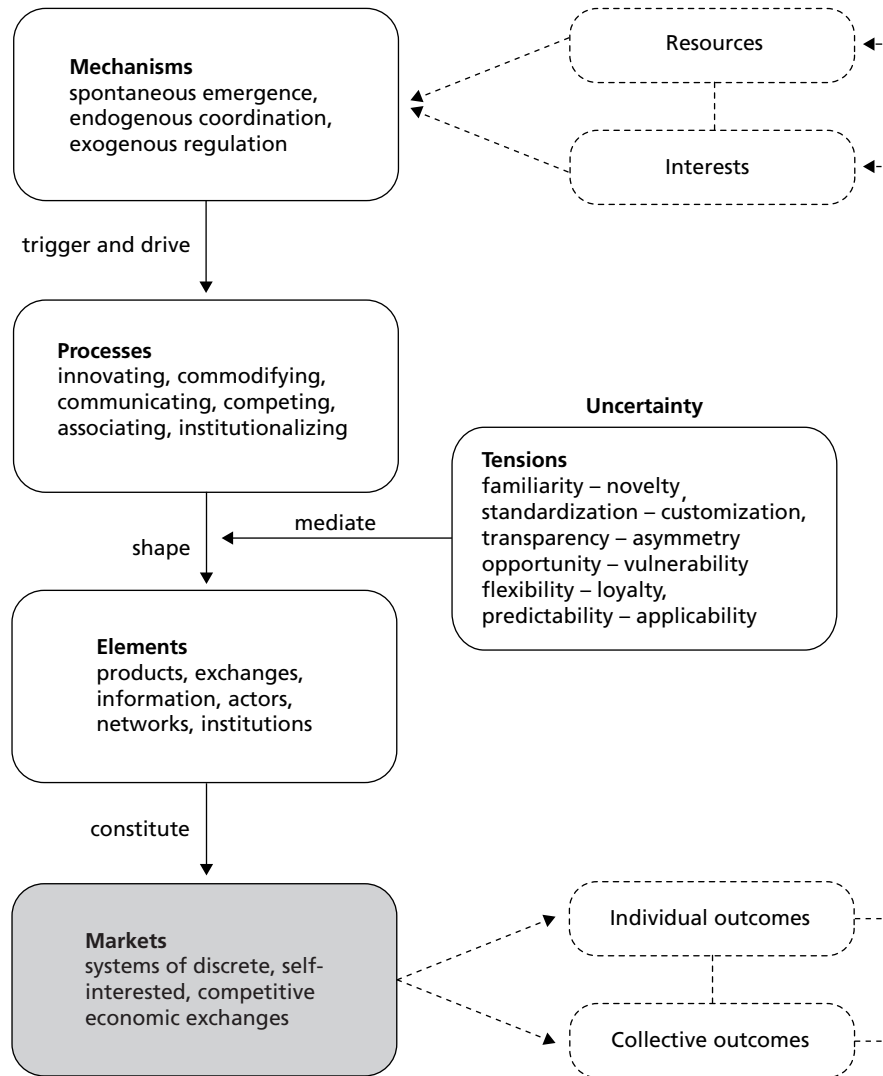
Multidisciplinary critiques of neoclassical market theory have given rise to a wealth of current research on various aspects of empirical markets that have been denied or neglected before (see for example Aspers 2006; Beckert 2009; Fligstein 2001; Lie 1997; Swedberg 2003). We have replaced references to “the market” with accounts of a broad empirical variety of markets in the plural and their typical preconditions, processes, and outcomes. Callon (1998: 47) emphasizes: “It is wrong to talk of laws ... of the market. There exist only temporary, changing laws associated with specific markets.” Along with a richer empirical basis, many theoretical perspectives of markets have been proposed alongside each other, conceptualizing markets as, for example, institutions, fields, systems, cultures, networks, regimes, discourses, practices, and mechanisms. Without denying the important contributions that have been made, a critical appraisal suggests that this field of research is relatively fragmented and in need of more integrative work and, further, that the concept of “market” is applied very loosely, calling for a reconsideration of what distinguishes markets from other socio-economic phenomena (see also Fligstein/Dauter 2007; Fourcade 2007). How can we make sure that when we talk about markets – and remind ourselves that every market is special – we are talking about roughly the same phenomenon, i.e. markets? How do various “markets-as-[insert favorite concept]” perspectives come together?

This call for integration and specificity in research on markets recognizes that any shared account of markets is more a social construction than an approximation to a positivistic reality. It is an epistemological rather than ontological endeavor to identify common points of reference for making sense of markets. Such points of reference are needed, though, to be able to discuss such things as the role of actors in market constitution. To what extent are they “making markets” or “made by markets”? Common points of reference are also needed to conceive of *different* forms and types of markets without losing the remaining similarities between them.

In this paper, I briefly outline a general framework for the analysis of market constitution (Figure 1). My approach takes into account that market economies consist of a multitude of interrelated markets and overarching institutional contexts (Fligstein 2001; White 2002). However, the purpose is neither to explain the constitution of entire market economies and capitalisms nor to shed light on the development of the social preconditions for markets in general (see for example Beckert 2009; Greif 2006; Fourcade/Healy 2007; Weber [1922]1978). While these aspects do come into play, my core interest is in developing a method for understanding how individual markets are

I thank Patrik Aspers, Jens Beckert, Daniel Beunza, Anita Engels, Peter Karnøe, Sigrid Quack, Raymond Werle, and Rolf Wüstenhagen for their very helpful comments on previous versions of this paper, Sabine Stumpf for her research assistance, and John Booth and Cynthia Lehmann for their language editing. The paper has also benefited from feedback at the Energizing Markets Conference in Copenhagen, October 30–November 1, 2008, as well as from lively discussions with colleagues during my time as Visiting Scholar at Columbia University, New York, in March and April 2009.

Figure 1 Framework for market constitution analysis



constituted, using solar power technology markets as a case in point. Special attention is given to how actors come to participate in such a market and shape its constitution, which involves – in a structuration theoretical sense – its initial establishment as well as continued reproduction and modification. However, while borrowing from structuration theory (particularly Giddens 1984), I prefer to refer to the *constitution of markets* in the general dictionary sense of “constitution” as the process of establishing, making (up), or forming markets (cf. *Oxford English Dictionary Online*), rather than solely to the *structuration* of markets in a narrower technical sense associated mainly with Giddens.

I build on a definition of markets as systems of discrete but related economic exchanges between self-interested actors who are in competition with each other. Note that self-interest and competition are regarded here as part of the *role* that market actors are expected to adopt and enact (more or less competently) and not as a given “natural propensity” (Smith [1776]1976: 17) of supposedly rational human beings and their organizations. The framework summarized in Figure 1 is based on the following logic: Market exchanges are possible when certain constitutive elements are in place. The elements are generated and reproduced in constitutive processes by which they gain their typical “market” features. In these processes, the problem of dealing with uncertainty is pivotal (Beckert 1996, 2009) and contains a number of tensions that influence whether and how a market can be constituted. Further, the processes which shape the constitutive elements of markets are triggered and driven by three different mechanisms: spontaneous emergence, endogenous coordination, and exogenous regulation. Finally, market constitution is framed by resources and interests on the “input” side and individual and collective outcomes on the “output” side (see Figure 1 for a full overview).

In applying the framework to solar power technology markets, I will focus on three examples of how the constitutive mechanisms operate in distinct but interrelated ways: the exploitation of technical inventions, business diversification, and political entrepreneurship. My analysis shows that the provision of solar power technology in *markets* (instead of other systems of exchange) is a complex social, economic, and technological accomplishment. The market cannot be taken for granted in this empirical case or, rather, the degree of its actual taken-for-grantedness is one measure of its constitution (degree of institutionalization).

This paper includes an illustrative account of how the market for solar power technology developed in Germany in the mid-1990s and beyond. From there being virtually no solar power installations in Germany in 1990, the market for this technology began to grow until the end of the decade at an average rate of around 50% in capacity, but still a modest overall volume with a total capacity of 36 MWp (megawatt peak) photovoltaic solar power in 1997 and 100 MWp in 2000. Since then, the growth has accelerated and over 800 MWp of capacity have been added (and technology sold) every year since 2004 (BMU 2008). This development is marked by important government initiatives in Germany, first with the Electricity Feed-in Law (*Stromeinspeisungsgesetz*) in 1991 and its successors in 2000 and 2004 – representing “the key element of renewable energy policy in Germany” (Wüstenhagen/Bilharz 2006: 1685) – and second with the Solar Electricity Program (*100.000 Dächer-Solarstrom-Programm*) of 1999. Remarkable new companies were founded in the 1990s, entered the stock market, and became key global players in this sector (see below). With the framework proposed in this paper, we can analyze the constitution of this market from many angles and thus avoid simplistically attributing the market’s emergence to regulation. Instead, we can focus in more detail on the constitution process from 1996 to 2000, when the market was in the making but was not yet as established as it was from 2001 onwards.

Systematic theoretical research on market constitution processes is rare. Fligstein (2001: 14) complains that too little consideration has been made of “where new markets come from.” It is telling that his contribution emphasizes the “architecture” of markets. He discusses the stable structures required for markets in general, but much less so the processes of building a specific market. Similarly, White’s (1981) seminal piece on where markets come from proposes an analysis of particular network structures rather than the constitutive processes that produce these structures (see also White 2002). Building largely on White, Aspers (2009) seeks to answer the question of *how* markets are made and, in particular, how order is achieved in new markets.

New Institutional Economics, on the other hand, is concerned mainly with the question of when coordination through a market is preferable to hierarchical (or hybrid) solutions, but again it hardly considers the processes involved in implementing or adapting a particular market (e.g. North 1990; Williamson 1975), despite some exceptions (Ensminger 1992). Alternatively, research in New Institutional Economics equates the firms’ role in the creation of new markets narrowly with firms’ activities in finding new customers with or without developing and commercializing new products (Anderson/Gatignon 2005). Making a market, however, involves more than just making more sales.

The approach developed in this paper contributes to a broader understanding of *how* markets are constituted as systems of exchange – rather than *why* they are constituted and *what* they look like when they are established. My main interest here is in the “marketization” of individual exchange systems. Research building on the work of Callon (1998; Callon/Muniesa 2005) has moved in the same direction, highlighting constitutive processes and the mobilization of resources.

2 Outline of an analytical framework for market constitution

It is the primary purpose of this paper to describe a general framework that can be used to analyze how different empirical markets are constituted over time. In this section I introduce and briefly explain the main assumptions and ideas behind the framework. The ambition of this paper and the framework in particular is not (yet) to devise a *theory* of markets, but to propose *heuristic* categories for understanding market constitution processes. In other words, the current added value is the provision of a fairly comprehensive and integrative set of things to consider and questions to ask when analyzing markets empirically. The comparability of studies on different empirical markets will be increased if they are analyzed using the framework described here. In response to Fligstein and Dauter (2007: 106–107), who identify “three theory groups” and worry about the sociology of markets resembling “the blind monks and preachers who fail to see the whole elephant in Buddha’s famous parable,” the framework presented here aims to be more comprehensive and integrative than the dominant perspectives to date

(see also the reference to “three major camps” by Fourcade 2007: 1019). The presentation of the framework in this section follows Figure 1 from bottom to top, i.e. from markets to mechanisms, and readers might like to keep referring to this figure as the text progresses.

Definitions of markets and market constitution phases

I propose that the analysis of market constitution should start from the following basic definition, which focuses on exchanges with particular characteristics: *A market is a system of discrete but related economic exchanges between self-interested actors who are in competition with each other.* The central phenomenon in what we refer to as a “market” is the economic exchange as such, i.e. the activity of buying and selling (Aspers 2005; Coriat/Weinstein 2005; Weber [1922]1978). A single, isolated exchange does not make a market, but it can be the seed of an emerging market. The existence of a market presumes that multiple exchanges take place over time. These exchanges are similar to each other, but discrete. At the same time, each exchange has to be seen in relation to other relevant exchanges occurring in the past, present, or future. The market represents a system of all the discrete exchanges that are related to each other. It will be part of the analysis to understand how, and to what extent, exchanges in a given empirical market have acquired these characteristics and a degree of “systemness” (Giddens 1984: 283) across time and space.

My proposed definition of markets also specifies the character, or “spirit,” of the exchanges in order to distinguish market exchanges from other interactions between actors (see also Biggart/Delbridge 2004). Following Weber ([1922]1978: 635–636), market exchanges are characterized as economic exchanges performed voluntarily among self-interested, intendedly rational actors (and any agents acting on their behalf) who are in peaceful, non-violent competition with each other over the arrangement and conditions of exchanges.¹ Self-interest and competition serve definitional rather than normative purposes here and enable us to distinguish markets from other exchange systems. Market actors, as such, seek to make deals to their own advantage (see also Aspers 2009: 6).

Actual markets vary significantly in size, stability, and sophistication. Nevertheless, *when market exchanges are regularly performed, this is the primary evidence that a market has been constituted.* This statement is not tautological, but expresses the important claim that structural conditions alone do not make a market (yet); there has to be action in the form of actual exchanges with typical market characteristics. By implication, in this way we can also distinguish phases of market constitution: the *market generation phase*,

1 To say that exchanges in markets are voluntary and peaceful does not belittle the imbalances in choice and power that exist among market actors, but serves to delineate markets, for example, from outright exploitation, robbery, and war (see also Aspers 2009: 6–7).

in which a market is not yet constituted but “in the making” as exchanges are envisaged but are not yet taking place; the *market continuation phase*, in which the performance of exchanges reproduces the market; and the *market termination phase*, when, for whatever reason, exchanges no longer take place and the market dissolves.² The market continuation phase can be subdivided further into young markets and mature markets, whereby exchanges in the latter take a much more routine form than in the former. Hence, in empirical research, one of the first questions to ask is whether exchanges are actually performed – in order to determine which phase of constitution the studied market is in.

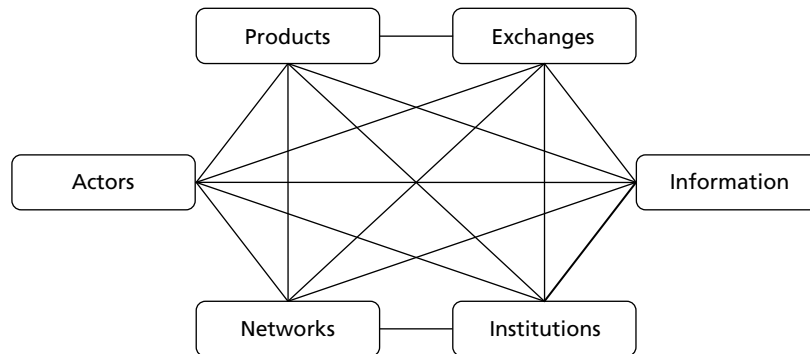
Constitutive elements of markets

The next issue is what enables the performance of market exchanges. Market exchanges are possible when certain constitutive elements are in place (see Figure 2). *Products, exchanges, information, actors, networks, and institutions represent the main elements required to constitute a market.* None of these elements should be overlooked in market analysis, but the list is likely to become longer or more detailed when applied in empirical studies. For example, the category of *institution* captures the whole spectrum from formal to informal rules and from regulative to normative to cultural-cognitive aspects (see Scott 2008: 47ff.).

Any such categorization of the elements needed to constitute a market is bound to fulfill primarily heuristic and descriptive purposes, even when the categories are relatively well established in the theoretical discourses from which they are taken and to which they relate. Notwithstanding the focus on exchanges in the previous section, the six elements are at the same level. Other market theories tend to adopt a “markets as ...” approach that identifies a conceptual core – e.g. networks, institutions, or products – to which other aspects of markets are subordinated. In contrast, the framework that I use here shows markets as an outcome of the interplay of a number of equally important constitutive elements. Note that the market actors in this framework can be not only individuals but also organizations, of course. Primary market actors are the buyers and sellers who are directly involved in market exchanges, and who have duly received most of the attention in research on markets to date. Secondary market actors are intermediaries and regulators who do not perform market exchanges but influence what buyers and sellers do. These secondary market actors must be recognized, too, particularly the state as a regulator, which is not a detached entity, but a proper market actor.

2 In a study on the development of technological paths, a similar distinction between generation, continuation, and termination phases is introduced by Sydow et al. (2007). This is a lifecycle model, assuming more or less gradual, non-deterministic transitions between phases. What I call the market generation phase is referred to by Fligstein (2001: 75) as market formation, comprising emergence, stability, and crisis, while Aspers (2009) conceptualizes a sequence of orientation, contraction, and cohesion.

Figure 2 Constitutive and interrelated elements of markets



If we analyze markets using only one of the categories, we overlook the fact that *the six constitutive elements of markets are interrelated and constitute the market as well as each other*. This means that in order to fully describe and understand any one of the constitutive elements of markets (and the market as such), we need to make references to the other elements. For example, institutions are not only supposed to enable or constrain market exchanges, but the exchanges also (re)produce institutions in return (e.g. Beckert 2009; Fourcade 2007). Hence, the interrelatedness of elements that I have in mind resembles the recursive logic that characterizes, for example, structuration theory (Giddens 1984). For instance, to say that market actors have to “avoid at least striking infringements of the rules of good faith and fair dealing” (Weber [1922]1978: 637) expresses both a restriction on actors and, on the other hand, their potential to maintain or destroy the market. This means, in particular, that market actors do not only influence the other constitutive elements but are also influenced by them in return. I will explore what this means empirically in due course.

Market constitution processes

Working backwards in the overall market constitution framework (see Figure 1 again), it is now time to ask where the six constitutive elements come from. That they constitute each other (see above) is only a partial answer to this question. More importantly, one specific market constitution process can be identified for each of the six constitutive elements (see Table 1, second column). The main idea is that the elements need to undergo a transformative process to acquire their market-constituting potential. Hence the analytical question that should be asked is how objects, exchanges, pieces of information, people, etc. become “marketized” and acquire market characteristics. *The constitutive elements of markets are shaped by distinct but interrelated transformative market constitution processes, labeled as innovating, commodifying, communicating, competing, associating, and institutionalizing.*

Table 1 Elements, processes, tensions, and mechanisms of market constitution

Constitutive elements of markets	Market constitution processes	Constitutive tensions in reducing and maintaining market uncertainty	Constitutive Mechanisms		
			Spontaneous emergence	Endogenous coordination	Exogenous regulation
Products	Innovating	Familiarity – Novelty	Discoveries and inventions	New product development	Precompetitive R&D funding
Exchanges	Commodifying	Standardization – Customization	Recurrent trade of a type of good	Quality management	Industry standards and requirements
Information	Communicating	Transparency – Asymmetry	Direct contact and negotiation	Marketing management	Provision of reports and infrastructure
Actors	Competing	Opportunity – Vulnerability	Entrepreneurial opportunism	Strategic management	Policies on antitrust and entrepreneurship
Networks	Associating	Flexibility – Loyalty	Recurrent interaction with known partners	Relationship management	Policies on cartels, consortia, associations
Institutions	Institutionalizing	Predictability – Applicability	Normalization, repetition, and objectivation	Contracting and institutional entrepreneurship	General legislation and cultural-political development
			Evolution	Management	Governance

Note: Cell content in columns four to six is illustrative, not exhaustive.

Specifically, *innovating* denotes the process that turns objects and inventions into new products (Callon/Muniesa 2005; Coriat/Weinstein 2005). *Commodifying* is the process that increases the similarity of exchanges, making them *market exchanges*, which is important because a market is constituted as a system of distinct but similar and related exchanges, facilitating the “calculativeness” emphasized by Callon (1998). *Communicating*, the third transformative constitution process in my framework, is transformative by making “facts” relevant and available to market actors, who then interpret and act on them (see also Akerlof 1970; Anand/Peterson 2000; Arrow 1974; MacKenzie 2006). *Competing* captures not only the structural condition of competition (i.e. multiple actors having a vying interest in making exchanges) but also the spirit in which market exchanges are initiated and performed; it is by competing that relevant actors turn into competitors and, thus, become market actors (see also Andersson/Aspenberg/Kjellberg 2008; Aspers 2005; Callon 1998; MacKenzie 2006; Weber [1922]1978). *Associating* is used here as a general term denoting the process of establishing relationships between actors that constitute networks, convey status, and work against the anonymity of markets (see also Aspers 2005; Podolny 1993; Rauch/Hamilton 2001; White 2002). Finally, *institutionalizing* means that certain rules of exchange and the sanctions attached to them are applied across many exchanges and become taken for granted (Berger/Luckmann 1966; Fligstein 2001; Scott 2008). Empirically, any one of the six transformative processes may be more or less advanced than the others at a particular point in time.

All the processes in my framework combine to capture what other accounts of market constitution refer to as the “value problem” (Beckert 2009: 253–257) and valuation, meaning the underlying processes of establishing the worth of an exchange. Valuation results from processes of innovating (when objects become products as actors recognize their value), commodifying (when the products become more comparable), communicating (when supply and demand are made transparent), competing (when actors become involved and priorities are assigned), associating (when a network of actors reproduces and protects a certain valuation), and institutionalizing (when the “marketability” of a product (Weber [1922]1978: 82) becomes taken for granted).

Moreover, *market constitution processes are ongoing; the constitutive elements need to be reproduced, and their characteristics change over time*. This means, first of all, that the simplified sequence shown in Figure 1 is repeated over and over again. The full framework captures a cycle and can be used to analyze new markets as well as mature or changing ones (Beckert 2008). It is a matter of degree whether a market is “young” or “mature,” and a new market can grow from an established one if there is considerable change in its constitutive elements. Geroski (2003: 69) observes that “there is a rhythm of displacement in markets – that new markets grow from the ashes of old markets – meaning that the dynamics of the development of a new market are likely to be affected by the response of producers in the old market that it displaces.” More generally, new markets may be very similar to older ones in that they borrow elements from related markets (Fligstein 2001: 78).

Note that “market constitution processes” are different from “market processes.” The former refers to substantial transformations of market elements, such as the general valuation of a type of exchange object, whereas the latter refers to price negotiations and other activities leading up to a discrete exchange. Prices mark specific instances in the interplay of the constitutive elements when actual exchanges take place in a sufficiently established market.

Uncertainty and constitutive tensions in markets

So far, I have argued that there are distinct, ongoing transformative processes that generate the constitutive elements of markets. This does not yet capture the full complexity of what happens in these processes. The framework needs to take uncertainty into account. Beckert (1996, 2009) argues that economic sociology in general and sociological theories of markets in particular revolve around the problem of uncertainty (see also Podolny/Hsu 2003). In my framework, I see market constitution processes as mediated by the need to maintain a moderate level of uncertainty, which can be high or low, but not extreme. *Market constitution requires that the uncertainty resulting from typical tensions in markets is reduced, but not eliminated, by applying and reconciling opposing forces.*

This idea cannot be fully explored in this paper, but a brief description of the basic tensions associated with each of the six constitutive elements and their processes will convey the general idea (Table 1, third column).³ First, the products that markets require are generated by innovating, but in the social process of constructing the value of a new product, a balance between familiarity and novelty needs to be struck (see Geroski 2003: 180–82). Second, while commodifying enables similarity between exchanges and is enhanced by standards, some customization is required that reflects the unique capabilities of the seller or the special needs of the buyer. Otherwise, offers will be indistinguishable, competition will be stifled, and the choice of exchange partners will be random. Third, while communicating promotes the transparency of information needed in a market in order for exchange partners to find each other and evaluate each other’s offers, it is also functional for market actors and the market as a whole to retain some information asymmetry because not everything is always relevant and many deals are only possible because different things are relevant (and valuable) to different actors (Akerlof 1970; Knight [1921]1971).

Fourth, actors become market participants by competing, but they are torn between the resultant opportunities and the vulnerability that the “market struggle” means for them

3 While I speak of constitutive tensions, Beckert (2009) identifies three inevitable coordination problems (valuation, competition, cooperation), and Aspers (2009) formulates three basic questions: what the market is about; how things are done; and what the value of an offer is.

when they initiate exchanges (Weber [1922]1978: 72; see also Adler/Adler 1984). Aspers (2009: 15–16) calls this the “orientation” phase, when market actors’ identities and interests are formed and they learn to play their roles as competitors looking for a good deal. Callon (1998: 17) speaks of the “framing of actors and their relations” in markets. Fifth, by associating, market actors maintain trusted network relationships based on loyalty, but also gain access to alternative partners. The importance of the flexibility provided by this opportunity to switch exchange partners should not be underestimated (Abolafia 1984; Granovetter 1985; Rauch/Hamilton 2001; Uzzi 1997). Finally, institutions are torn between predictability and applicability, because highly specific rules increase the former but reduce the latter, and very generic rules, in return, may be widely applicable but interpreted and implemented in unpredictable ways (Abolafia 1996).

A detailed examination of these constitutive tensions will be instructive for explaining variance across markets, because each empirical market will reconcile the tensions in idiosyncratic ways, depending on the nature of its constitutive elements as well as the phase and history of its constitution overall. The particular balances in a market at any given point in time are not simply a matter of economic equilibrium and efficiency. They reflect earlier and ongoing cultural and political influences on the market, path dependencies, and the intensity of business cycles and fashions (Fligstein 2001; Greif 2006). Analytically, the tensions serve to mediate market constitution processes and explain why “pure markets” are never realized and why every market is a special case.

Constitutive mechanisms

The framework for analyzing market constitution, in the narrower sense, is made complete by the mechanisms that trigger and drive market constitution processes (see Figure 1 and Table 1, fourth to sixth columns). Extending Hayek’s (1973: 35ff.) distinction between *cosmos* and *taxis*, as well as common notions of evolution versus governance,⁴ I propose a simple heuristic distinction between *three* constitutive mechanisms which capture and integrate three very broad theoretical traditions in explaining the occurrence and development of markets: *Market constitution processes are triggered and driven by the constitutive mechanisms of spontaneous emergence, exogenous regulation, and endogenous coordination.*

First, in this conceptualization, the mechanism of spontaneous emergence is based on the desire to make exchanges without the vision of establishing a full “market” for one-

4 Broadly in line with Hayek’s concepts, Aspers (2009) conceptualizes “spontaneous coordination” and “organized coordination.” I think it is important to distinguish not only between unintended and intended coordination efforts, but also to capture whether intended coordination originates endogenously or exogenously (see also Aspers’s distinction between “state-governed” and “self-governed” market making).

self and others. Second, exogenous regulation is undertaken to create a market, i.e. to stimulate and regulate market exchanges from the outside without any intention of participating directly in the market. Third, I add the mechanism of endogenous coordination in markets which presumes that the actors within the market look beyond individual exchanges and have an interest in the existence of particular markets as larger exchange systems in which they will be directly involved (see also Aspers 2009; Greif 2006). This comes close to Chandler's (1977) idea of the "visible hand" of management and its influence on markets. Spontaneous emergence is an unintentional mechanism, while the other two are intentional with a view to market constitution. In another dimension, the distinction is based on whether the mechanism originates inside or outside the market as an exchange system, hence endogenous coordination versus exogenous regulation. Spontaneous emergence is a mechanism that works prior to the point at which the market is established (in the sense of exchanges taking place regularly), and it is neither inside nor outside the market. If its effect continues, its source can be located inside or outside later on.

My colleague Patrik Aspers (2009) has sketched a typology of market-making processes, distinguishing between spontaneous, self-governed, and state-governed market making, which is roughly analogous to the three mechanisms I propose here. While our conceptualizations go together well, I do not limit the external regulation of markets to the state, I put more emphasis on questions of intentionality and insider/outsider status, and I place the mechanisms in a larger framework of market constitution.⁵

It is important to note that the three types of mechanisms all have an effect on market constitution and are related to each other in the sense that one may prompt the other. While each of the three constitutive mechanisms outlined here warrants a much more detailed analysis, their interplay is probably the most interesting issue to be studied further, especially if we presume that none of the mechanisms is principally superior to the others, nor that one mechanism alone will be sufficient to explain the constitution of a specific, empirical market. The contribution this framework makes, even in this rough outline, is to give equal space to evolution, management, and governance (see Table 1, bottom row). The constitutive mechanisms described here already anticipate the tensions that are typical of market constitution processes as referred to above, for example the tension between familiarity and novelty in new product development.

Framework boundaries, inputs, and outputs

The preliminary boundaries of the framework are also given in Figure 1. Specifically, market constitution in the narrower sense begins with the constitutive mechanisms

5 Aspers (2009: 25–28) includes hypotheses on which market-making type is likely under which conditions.

and ends with the creation and maintenance of a system of discrete, self-interested, and competitive economic exchanges. Beyond the boundaries of the model lie, on the input side, the resources and interests that enable the constitutive mechanisms to operate and, on the output side, the individual and collective outcomes of markets (Swedberg 2003). When inputs and outputs are connected, the analytical framework forms a loop which matches the idea that market constitution is dynamic.

Taken together, interests and resources represent the power that goes into the market constitution mechanisms described. Fligstein (2001) points to the political-cultural dimensions of market constitution and stresses that “[r]ules are not created innocently or without taking into account ‘interests’” (p. 28). Different power distributions may explain, for example, why some markets are driven more by exogenous regulation or endogenous coordination than others. Resources, both material and immaterial, are not simply the means to realize interests but, rather, they often embody ideas and values that shape interests in the first place (Callon 1998). And the interests that motivate participation in markets as a seller or buyer go beyond the display of competitive self-interest expected within the market. The constitutive mechanisms draw on social, cultural, and political contexts outside of the market (Beckert 2009; Fligstein 2001). This also applies to the individual and collective outcomes of market exchanges that market actors and society at large will analyze in order to determine whether a continuation of market exchange is desirable. As outcomes shape the resources and interests for the next sequence of market constitution, inequalities in terms of power and welfare outside of the market are carried over into the subsequent market development and the strategic actions of market actors. The inherently political nature of market constitution must not be overlooked

Implications of the framework for empirical studies of markets

All the points raised above imply a comprehensive set of questions to be asked and answered by empirical research into specific exchange systems. Do they have the typical characteristics of markets? Are exchanges taking place, or is the market in an earlier or later phase of its constitution? Can we identify products, exchanges, information flows, actors, networks, and institutions? What makes them relevant and what makes them special, compared to other markets? How are the typical tensions dealt with, which market constitution processes are critical, and do we find manifestations of the three constitutive mechanisms?

The framework proposed here is intended as a heuristic model for the systematic description and comparison of all sorts of markets that will reveal common patterns of market constitution as well as the unique features of particular markets resulting from their history and stage of development. Once patterns emerge across a larger number of different markets, it is also possible to construct new typologies of markets, building

for example on differences in the six constitutive elements. Hence much further work is required as the framework is applied to reinterpret prior research and to conduct new studies of markets. In the remainder of this paper, I will illustrate the potential of the framework by applying it to the case of solar power technology markets in Germany.

3 Examples from solar power technology markets: Green inventors, diversifying giants, and political entrepreneurs

In this part of the paper, I will give three tentative accounts of market constitution processes in solar power technology markets, based on the framework outlined above (see Figure 1 for reference when reading the following sections). The three examples are chosen to represent market constitution processes triggered by spontaneous emergence, endogenous coordination, and exogenous regulation respectively, but it will also become rapidly clear how strongly these mechanisms are related to each other.⁶

Figure 3 documents the growth of solar power technology markets in Germany in terms of the installed capacity of photovoltaic power in megawatt peak (MWp) since 1990.⁷ Not only was total capacity built up around the country over the years, the annual growth in capacity of new installations increased almost every year as well, indicating a very significant and presumably attractive market growth (BMU 2008). This is confirmed by figures from the *Bundesverband Solarwirtschaft*, a trade association, which shows the total annual turnover in the photovoltaics sector to have grown from around €201 million in 2000 to around €7,000 million in 2008 (BSW 2009). Given that crucial supportive legislation was implemented in Germany in 1991, it is interesting to see that the market still took some time to take off (see also Jacobsson/Sandén/Bångens 2004). The transformative processes outlined above were just getting started. Hence, in the mid-1990s, key companies had to be founded. They had to be in place with their products and networks to make the boom from 1999 onwards possible when further legislation and funding programs were implemented to help this market grow. By 2008 about 130 firms were producing solar power cells, modules, and installations in Germany (BSW 2009). On the demand side, considering the future provision of energy, solar power has been “the most attractive energy source in public opinion” (Wüstenhagen/

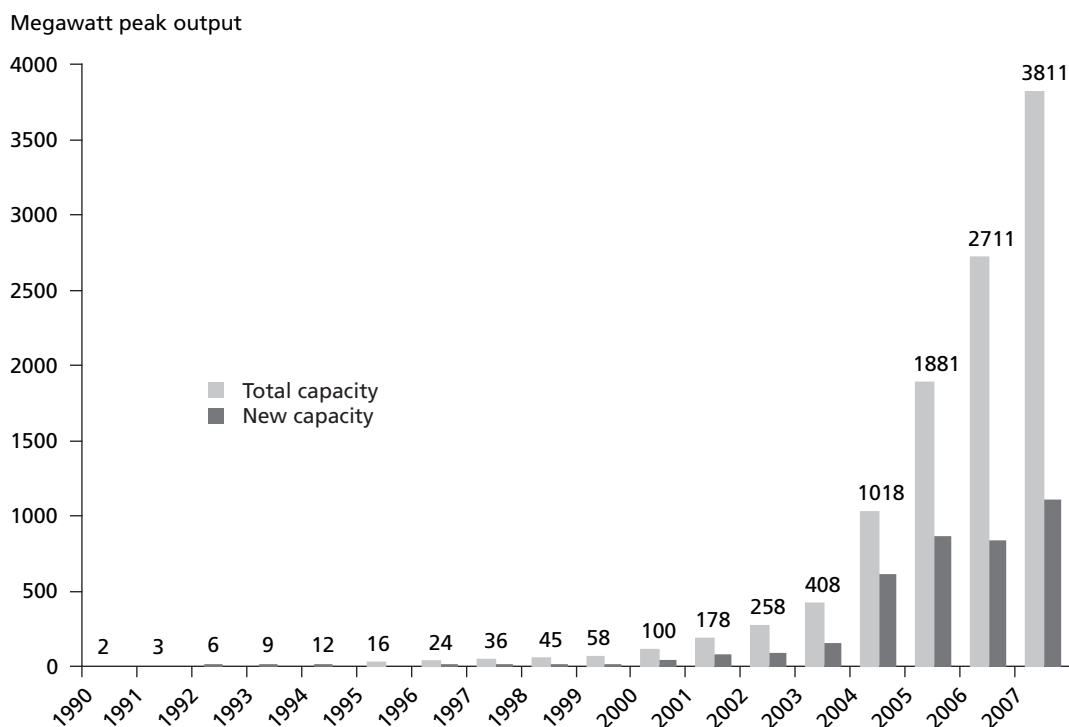
6 The developments described in this section are based on secondary sources, especially newspapers and online media, as well as personal recollections of the Solon case. Note that the account is mainly illustrative at this stage and for this paper. The project this section is based on is still ongoing.

7 My analysis starts in 1990 in line with Jacobsson/Sandén/Bångens (2004: 12), who distinguish between a preparatory phase up to 1989, which included public discussions on the oil crises concerning shifts to non-fossil energy sources as well as important technological developments in this direction, and a market-building phase after 1990 (see also Wüstenhagen/Bilharz 2006).

Bilharz 2006: 1682) since the early 1990s. Public opinion was favorable, but the market for the technologies required still had to be constituted.

Below, I apply the framework for market constitution analysis (Figure 1) to the case of solar power technology markets in Germany to show how it helps to identify the processes behind a market development such as the one illustrated numerically in Figure 3. The case of solar power in Germany can only be fully understood if it is also seen in a transnational context; however, for presentational reasons, the account here is limited to Germany, while the international reach of activities by the actors studied is fully recognized. Moreover, the development of solar power technology markets in Germany has to be understood in the broader context of renewable energy markets there (e.g. Jacobsson/Sandén/Bångens 2004; Wüstenhagen/Bilharz 2006). Solar power still plays a small role in the total energy generation in Germany, even though its own growth rates are impressive, accounting for 3.5% of power production and less than 1% of consumption in 2007 (BMU 2008).

Figure 3 Total and newly installed photovoltaic capacity in Germany



Source: Federal Ministry for the Environment, Nature Conservation and Nuclear Safety, Germany (BMU 2008).

Spontaneous emergence: Green inventors turned global business players

As part of the revival of solar power cell manufacturing in Germany in the mid-1990s, companies such as Solon SE (formerly Solon AG) and SolarWorld AG, which would soon become major players, started out as fairly small enterprises in the solar power sector. From the point of view of market constitution, Solon and SolarWorld emerged rather spontaneously and have evolved with the market. To be sure, their founders were looking for economic opportunities for themselves, but they did not set out to create a market for solar power technologies for everyone.

In the case of Solon, founded in 1996, the initial venture brought together a set of highly idealistic people in Berlin who believed in renewable energy sources and were interested in inventing technological solutions. Wuseltronik, the key precursor to Solon, saw itself as a socialist engineering collective – as opposed to capitalist market makers. In the case of SolarWorld, established in 1998, a small firm offering diverse engineering services related to renewable energy sources since 1988 managed to secure a major public contract for installing solar power generators on a public building in Bonn. Hence, SolarWorld reacted to a demand-side market impetus. The company's founder, Frank Asbeck, was a politically active environmentalist, but it was this contract, actually the biggest photovoltaic installation in the world at the time, that somewhat coincidentally led his small firm to grow specifically in the solar power sector. Both Solon and SolarWorld are cases of small, green, inventive engineering companies that became major global players in solar power technology markets. They also have in common the fact that they went from buying solar cells for the devices they made to manufacturing solar cells themselves. They went public quite quickly and were listed on the stock market in 1998 and 1999 respectively, which was generally seen as an indication of the feasibility of solar power technology markets.

For market constitution analysis, the first few years of these companies' existence are particularly interesting. The steep learning curves and the transformations that they had to undergo are quite remarkable. They had to turn from idealistic engineers into actors in a new market. While they were being "marketized," they were also driving the development of solar power technology markets in Germany and beyond. The analytical question is: What enabled Solon and SolarWorld to participate in the market and, thereby, to contribute to its creation? Specifically, how did they affect the constitutive processes and elements of the market? The following account is structured using the categories of the analytical framework shown in Figure 1 and Table 1.

Innovating products

First, regarding products, I already mentioned that the two companies started off buying solar power cells made by others (e.g. SolarWorld imported BP Solar's technology) to build them into more complex modules and installations. Hence, a major transfor-

mation they underwent was to develop their own products (solar power cells). Solon set up its own plant in Berlin-Kreuzberg, while SolarWorld initially went the way of acquiring other manufacturers before establishing its own factories later on. They both invested many resources in product innovation, building on their prior knowledge as buyers as well as developing and acquiring new patents. Interestingly, in terms of the constitutive tensions of markets, both companies focused initially on the photovoltaic technologies most common and familiar in Germany and not the more novel thermal technologies. Solon and SolarWorld did not invent a completely new product category, but they contributed to market constitution by extending the range of products and the capacity of production available in a growing market.

Commodifying exchanges

Regarding the commodification of products so that comparable exchanges can take place in a market, it is interesting to note with respect to the tension between standardization and customization that Solon and SolarWorld retained a relatively high level of customization by integrating the production of relatively standardized solar power cells with the design of devices and installations that could be tailored to specific needs. In this way, the companies contributed to market constitution by offering exchanges with an added value beyond the solar technology as such, i.e. they were selling expertise as well as hardware. As new players in the emerging market, their main concern was also to engage in enough exchanges in the first place in order to be able to grow beyond their prior business and achieve returns on their new investments.

Communicating information

As far as market information and communication flows are concerned, both Solon and SolarWorld, starting out as small enterprises, had to learn as they grew to serve not only a small number of customers directly known to them but also a larger mass market, taking advantage for example of the 100,000 Rooftops Solar Electricity Program of the German Federal Government (administered by KfW bank). The companies also had to get used to greater transparency requirements of their investors, who wanted to see their market data and projections. Solon, in particular, ran into serious difficulties in this regard in 2001.

Competing actors

Probably the biggest transformation that both companies underwent was to actually become *market* actors, i.e. to see themselves as not only (or even primarily) inventors of promising green technologies but as global business players in a still nascent but already highly competitive market (Lorenz/Pinner/Seitz 2008). This is, in other words,

the “marketization” of these actors as they adopt market logic. In the case of SolarWorld, its original founder, Frank Asbeck, has managed to evolve in his own role with the company, and he is still heading the firm successfully. In the case of Solon, however, the initial “gang” of idealistic entrepreneurs ran into trouble and was soon replaced by financial directors and other professionals who had no experience or commitment in the solar sector but who knew how to manage a company in a complex and difficult market environment by focusing, for example, on the core profitable business areas. Solon and SolarWorld had to learn to compete and be competitive as is expected of market actors, especially the big players. At Solon, some did miss the cozy Kreuzberg days.

Associating networks

The Solon and SolarWorld cases are also interesting in how they built networks within the solar power technology markets. Being small firms with ambitious projects to start with, they had to convince their own investors and customers that they could actually deliver. An important part of SolarWorld’s strategy was to not only cooperate but actually acquire important suppliers. Solon attempted more of an organic growth strategy in the beginning, but when the company had to announce huge losses in 2000, it started looking for strategic partners and announced cooperative agreements, which did not fully convince its investors at the time, however. In terms of market constitution and the role of networks, SolarWorld went for less flexibility and more integration, while Solon was looking for trusted partners and less integration. It is also clear that the solar power technology market was not constituted merely by arm’s-length exchanges but, more importantly, by building durable relationships between buyers and sellers, i.e. supplier networks (see for example Baker/Faulkner/Fisher 1998).

Institutionalizing market institutions

Companies like Solon and SolarWorld played a key role in the institutionalization of solar power technology markets in Germany. It is important to note that virtually no solar power cells were manufactured in Germany anymore by the 1990s (Jacobsson/Sandén/Bångens 2004: 16) and that the new companies were thus important examples of what could be accomplished. Because they not only survived but were also actually successful in the stock market, it became “normal” after a few years for solar power cells to be made and sold in Germany. It is well known that government initiatives and regulations also played a big role in making the market possible (as will be discussed below), but market constitution nevertheless required companies like Solon and SolarWorld that would seize the opportunities, become market actors, and perform market exchanges regularly and “normally.”

Endogenous coordination: Diversifying giants looking for dominance

We can contrast the start-up scenarios of Solon and SolarWorld with BP Solar, a full subsidiary of BP (the outcome of the merger between British Petroleum and Amoco). BP Solar has a distribution center in Germany but manufacturing facilities only in the United States, Spain, India, Australia, and China. If we look at the 1990s again, the time when Solon and SolarWorld were founded, BP Solar plays a very different role in the constitution of solar power technology markets. First of all, BP Solar as part of a gigantic corporate group brings immense resources to the solar power markets and could afford, for example, to remain unprofitable until 2004. However, BP Solar also has to compete for investments with other business units in BP, not only with the oil division but with units engaged in other alternative energy sources from biofuels to wind power. Secondly, BP started diversifying its business a long time ago and has been active in the solar power sector for more than 30 years, producing both solar power cells and full installations. In the 1990s, the company already had several solar power cell manufacturing facilities around the world and one of their customers was SolarWorld, set to become a competitor later. Even though solar power technology markets were still emerging 15 years ago – and probably they still are today – we can state for analytical purposes that BP Solar was already a market actor at that time and that its activities contributed to the endogenous coordination of market constitution (according to Figure 1 and Table 1).

Innovating, commodifying, communicating

Even in its role as an incumbent, though, BP Solar had to invest heavily in innovation and new product development, generating new products for the emerging and growing solar power technology markets. A key problem in this market was that the efficiency of the products needed to be vastly enhanced in order to be able, one day, to compete with other sources of energy without requiring public subsidies (Jacobsson/Sandén/Bångens 2004; Lorenz/Pinner/Seitz 2008). The new products needed to be commodified as alternatives to gas and oil, for example, apart from the competition with other renewables. The advantage of BP Solar was that it could fund its R&D from within the BP corporate group, meaning that they viewed government funding of new firms (but not so much the subsidies to customers) with some suspicion, because the new entrants such as SolarWorld would increase competition in the market (if one did a competitive analysis based on Porter 1980). When it came to the actual exchanges and information flows required for market constitution, BP Solar had the advantage of drawing on BP's corporate experience in quality management and marketing – but also the legacy of being seen as an oil company with less credibility “beyond petroleum.”

The demand for new products from solar power technology manufacturers such as BP Solar, or firms like Solon and SolarWorld, is affected by changes in valuation on the part of energy consumers and the introduction of “green power” products by energy marketers (see Wüstenhagen/Bilharz 2006: 1689–1691). While solar power may still be

a niche market, private households can pull the market from the demand side. When they buy a green electricity mix, they legitimize and necessitate the installation of new capacity, especially for the very popular but expensive solar power.

Competing, associating, institutionalizing

BP Solar did not have to transform itself into a market actor but was “marketized” from the start and strategically designed to create and exploit profitable business for BP. Regarding the extent to which BP Solar’s relationship management influences the network structures in the solar power technology markets, it is hardly surprising that the company cooperates regularly with R&D institutions and manages sophisticated supply and distribution networks. Their products go to households or businesses as end customers, but BP Solar (like its competitors) tends not to sell directly to them but to certified wholesalers and smaller engineering companies specializing in solar module installation (such as SolarWorld initially). When it comes to influencing the institutionalization of solar power markets, BP Solar draws on BP’s huge public relations machinery and keeps sending the message that it is only a matter of time and persistent product development before the markets are viable. It can be noted that the endogenous coordination performed by BP Solar is designed to maintain a strong position and even to gain dominance in the market, with much less interest shown in opening the market up, much less reliance on external subsidies, and much more belief in the continued dynamic of a fast-growing market with much future potential. BP Solar clearly helps to constitute the market but, unsurprisingly, seeks to shape it in its own business interest. The company also labels solar power a “profitable investment” instead of, for example, pointing to the hazards of climate change. This is very different from the early days of Solon and SolarWorld, whose founders wanted to make money but also saw their market participation in much more idealistic and publicly spirited terms. Solon’s company logo, for example, features the slogan “Don’t leave the planet to the stupid” (www.solon.com).

Exogenous regulation: A political entrepreneur generating momentum

To understand the influence of external regulation on solar power technology markets, especially in the German context, one should consider legislation such as the Electricity Feed-in Law of 1991, replaced in April 2000 with the national Renewable Energy Sources Act (*Erneuerbare-Energien-Gesetz*), as an outstanding motor of market constitution. The core mechanism of this legislation is a purchase obligation for the public grid operator plus a price guarantee above market prices granted to investors who install new solar power generators and provide energy to the public grid (see Wüstenhagen/Bilharz 2006: 1685; a further important element is a nationwide settlement system to balance out regional disparities). This has made solar power technology much more attractive for customers and has meant business opportunities for suppliers like BP Solar, Solon,

and SolarWorld. 157,000 jobs related to renewable energies were created by 2004 in Germany alone (BMU 2006: 6). The trade association BSW reports around 48,000 jobs in the photovoltaics sector in 2008, up from about 1,500 in 1998 (BSW 2009).

In this short illustration, I cannot analyze the whole political process and the debate on renewable energy sources in Germany, but I can illustrate the role of exogenous regulation for market constitution by reference to the most prominent political entrepreneur to play a pivotal role in generating momentum for solar power in Germany and beyond: Hermann Scheer. I am certainly aware that we need to be careful and avoid attributing too much agency to individuals like Scheer, whose influence is obviously dependent on certain societal conditions and resources that work for him, against him, and with him (Lawrence/Suddaby 2006). Nevertheless, he is an outstanding figure who possesses “projective agency” (Emirbayer/Mische 1998) and has been involved in organizing core initiatives that have shaped solar power technology markets by external regulation.

Scheer himself is outside of the markets in the narrower sense because he does not engage in market exchanges, i.e. he does not appear as a buyer or seller of solar power equipment. He is still a relevant market actor, though, because it is his mission to promote solar power broadly and to do so effectively by advocating a regulated market economy relying on private investments and market exchange, aided by public subsidies until the market is self-sufficient. Scheer is a political scientist by education and a political activist by calling. Since 1980, he has been a Member of Parliament in Germany (Social Democrats) and has used this position to introduce environmental legislation such as the 100,000 Rooftops Solar Electricity Program in 1999 and the Renewable Energy Sources Act in 2000. Wüstenhagen and Bilharz (2006: 1687–1688) point out that it was parliamentarians like Scheer – rather than government ministers, industry leaders, or public opinion – that drove the legislative initiatives. Scheer is also the founder and president of EUROSOLAR, the European Association for Renewable Energies set up in 1988, which initiated the World Council for Renewable Energy, of which Scheer is also General Chairman (see also Jacobsson/Sandén/Bångens 2004). Moreover, he is a prolific author and speaker, publicizing his vision of solar power and renewable energy at every opportunity. His initiatives and ideas have been recognized by numerous awards including the Right Livelihood Award (“Alternative Nobel Prize”) in 1999.

How can we interpret his impressive vita in the light of the constitution of markets for solar power technology (see Table 1)? First of all, the scenarios of energy provision in the future, which Scheer has sketched in his books, articles, and speeches, have given legitimacy and motivation to actors interested in developing products for solar power markets, such as the founders of Solon. Second, his legislative initiatives have produced economic incentives for private suppliers and buyers of solar power technology to engage in market exchanges. Through EUROSOLAR, founded in 1988, Scheer has given the solar power industry and all other stakeholders in renewable energy a platform for exchanging information on alternative energy markets, enabling the key players to interact and to publicize their successes and concerns. By joining this association, mar-

ket actors get organized, gain recognition, and become involved in long-term market development and political discourses. The activities of EUROSOLAR work against a short-term investment orientation and thus stabilize the solar power markets, which might otherwise collapse in times of low profitability. It is certainly also the aim of Scheer personally and EUROSOLAR as an association to influence the cultural and political climate around the world and to build a global social movement in support of solar power (Jacobsson/Sandén/Bångens 2004). Although he clearly has not done so single-handedly, Scheer has shaped significantly the current governance of solar power markets in Germany and beyond.

4 Summary, discussion, and conclusion

The previous section provides a preliminary but clear analysis of how spontaneous emergence, endogenous coordination, and exogenous regulation have triggered and driven constitutive market processes and contributed to producing the constitutive elements of solar power markets in Germany. In future studies, it will be particularly interesting to analyze in more detail how the mechanisms are interrelated. For example, political agitation and legislation outside of the market paved the way for endogenous initiatives such as BP's investments in solar power as well as the emergence of Solon and SolarWorld. BP's position is intriguing because BP Solar has helped indirectly to build its own competition, i.e. SolarWorld, but the new entrants do not only challenge BP, they also help to grow and stabilize the solar power markets, which is desirable from BP's long-term point of view, too. It is noteworthy that solar power markets in Germany are now already institutionalized in the sense that it is taken for granted that the provision of solar power technology will take place through private markets (Jacobsson/Sandén/Bångens 2004) – even if they are heavily subsidized – and not mainly through public infrastructure projects (e.g. solar power plants built, owned, and run by the state). This is most evident in the move towards establishing solar power companies as publicly listed firms that have to perform in the stock markets, which means that they are not only assessed in their capability to provide green technologies per se, but also in their growth, efficiency, and profitability as market actors.

In summary, the relevant market actors including buyers, sellers, intermediaries, and regulators have built solar power technology markets purposefully and signaled that the solar future has to be situated within a market. This means that technologies initially had to become marketable products; exchanges had to become standardized and comparable; not only technical features needed to be specified, but also prices and delivery times; the providers and users had to start competing and be sellers and buyers; associations had to be created in anticipation of future trade in the market; and, last but not least, the institutional framework needed to be developed to legitimate profit motives in an environmentalist, even anti-capitalist domain. At the same time, the market has been

kept permeable in order to be able to draw on the resources of social movements that have a non-market or even anti-market orientation. The market philosophy of solar power is also fairly loose, given the realization that the intended markets have not been feasible so far without exogenous protection and promotion by governments.

The details of the analytical framework I have outlined and applied in this paper are a subject for future research and refinement. The framework captures the fact that markets differ in the way they are constituted, especially because of the inherent tensions that mediate market constitution processes. The framework provides categories that enable us to make comparisons between markets and trace changes in markets over time. For example, the analysis of the German solar power technology markets sketched out in this paper could be extended to further countries, more forms of energy generation, other technological innovations, or pre-1990 developments. Propositions can be derived from this framework once it is applied to a larger number of different markets so that typical patterns of market constitution become apparent. Key theoretical questions that remain to be answered are the relative importance of the constitutive mechanisms, the balance in the constitutive tensions, and the degree to which the six constitutive elements need to be fully constituted for systematic exchanges to take place.

Future research, my own ongoing empirical work included, will bring out the practical and theoretical value of the framework for the analysis of market constitution outlined in this paper. I argue that we will understand markets better when we examine the three constitutive mechanisms, the six constitutive processes with their typical tensions, and the six constitutive elements of markets as special systems of economic exchange in the context of the resources and interests that they draw on and the individual and collective outcomes they produce.

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