Partnerships in implementing sustainability policies – theoretical considerations and experiences from Spain

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Abstract

The greening of economic and industrial activities requires that new relationships be formed between private actors who often never met before on the business or policy arenas. To initiate and give direction to the sustainability transition, public actors may choose to become involved in partnerships for policy implementation, next to industrial prime movers. After having catalyzed the process, *new forms of public-private partnerships* may emerge, in the transition towards 'green private-private partnerships'.
This paper presents theoretical considerations regarding the types and evolution of public-private partnerships (PPPs) involved in the implementation of sustainability policies. The central argument is that PPPs are themselves in a process of transition, with changes in the types of activity, types of investment and types of financing on which partnerships focus.
Empirically, the paper analyses the greening of the electricity industry in Spain and looks specifically at the cases of wind electricity and biomass technologies' diffusion. The evolution of PPPs shows clearly that there is a transition from 'project-vehicle-partnerships' to 'technology-specific-partnerships' to 'renewables-development-partnerships'. In parallel there is a transition from 'internally-financed-partnerships' towards 'bank-financed-partnerships' with a substantially higher diffusion potential. Finally, another transition was observed from 'learning-partnerships' towards 'commercialization-partnerships'. As the greening of the electricity industry advances, there is a gradual retreat of public actors and an increase in new green private-private-partnerships.
Through these analyses, the paper fits into the conference theme regarding the dynamics for public-private partnerships. In the same time it is relevant for the theme regarding the implementation of public policies and technologies to promote sustainable development. Understanding the metamorphosis of partnerships supports policy-makers to design policies facilitating wider engagement in PPPs, a more secure operation environment and a faster transition towards new green private-private partnerships in industrial activities. The paper draws in postdoctoral research and is aimed for oral presentation in the workshop "Dynamics of public-private partnerships in implementing sustainability policies".

1. Introduction

The greening of economic and industrial activities requires that new relationships be formed between private actors who often never met before on the business or policy arenas. To initiate and give direction to the sustainability transition, public actors may choose to become involved in partnerships for policy implementation, next to industrial prime movers. After having catalyzed the process, new forms of public-private partnerships may emerge, in the transition towards 'green private-private partnerships'. This paper presents theoretical considerations regarding the types and evolution of public-private partnerships (PPPs) involved in the implementation of sustainability policies.

The paper is organized in the following sections. Section 2 presents the theoretical considerations of the paper. Since sustainable development can be understood as an implementation process (Bressers, 2004), it tackles the issue of policy implementation processes, based on the Contextual Interaction Theory that takes an actor-centered perspective on implementation. The next sections of the paper present some empirical evidence, by analyzing the greening of electricity production industry in Spain. Within Section 3, Section 3.2 looks specifically at the case of wind technology diffusion since mid 1980s while Section 3.3 concentrates on the diffusion of biomass electricity technologies and the role of PPPs. Further, Section 4 elaborates on the role of public-private partnerships in implementation and the transition towards new-green-private-private-partnerships. Section 5 presents the conclusion of the paper.

2. Public policy implementation and public-private partnerships

2.1. Policy implementation as a key condition for sustainable development

This paper concentrates on the role of partnerships in implementing sustainable development policies. By 'implementation' we mean here the process(es) that concern the application of relevant policy strategies. Such processes can, of course, work as intended. But is it also highly possible that application is hindered, delayed or even prevented during the process.

Why raise this issue with respect to the achievement of sustainable development? Is not such a focus too narrow for the broad and complex goals of the sustainability challenge? Governance for sustainable development appears to require highly interactive and co-operative mechanisms; the overcoming of value dilemmas; the building of international institutions; local empowerment; new partnerships between public and private decision-makers, and between them and NGOs – etc., etc. In this context a discussion on implementation may seem both overly narrow and – in the more general context of policy analysis – 'traditional'. However without real implementation taking place ultimately, all of the new approaches mentioned above 'vanish into thin air'. Therefore the purpose of the paper is to combine and give substance to the relationship between innovative partnerships and the down to earth task of implementation.

A frequently used conceptualization of policy implementation involves the concept of 'policy *process*' and heuristic of 'policy stages'. The process orientation draws attention to the division between sub-processes within the overall policy process. The classical 'stages' model of the policy cycle raises the question of the extent to which such apparently sequenced sub-processes are analytically discernible constructs and whether they can be identified in real life (DeLeon 1999). Often a policy program envisages application at a 'lower' level of government, identifying this as the 'implementation stage' of the policy. But what does the

labeling of sub-processes mean for the successive involvement and action of many administrative levels in complex policy systems? In European climate policy, for example, there are global, EU, national, and in many instances provincial and local levels. What appears as policy implementation for one level may be thought of as an aspect of policy formation for the next level, and so on down the chain. How in this perspective can, and should, the implementation 'stage' be distinctly understood as a crucial element of overall goal attainment?

In principle we argue that while it is indeed still fruitful to make an analytic distinction between the 'policy formation' and 'policy implementation' processes, the characterization of 'real life' processes is not always self-evident. The analytic distinction is that 'policy formation' indicates those processes or sub-processes that involve the conversion of diffuse inputs into a more focused output; while 'policy implementation' indicates processes that involve turning a more or less focused input (the 'policy') into a number of diffuse outputs. We conclude, therefore, that there are systematic features of the implementation process - namely the institutional and resource context of the policies - that could and should be employed. Thus it is quite possible that, in a 'chain' of successive 'real-life' processes - each following, for example, at a 'lower' (more limited) scale of responsibility and action - more than one process would be labeled and analyzed as an 'implementation process'. Figure 1 pictures the processes, inputs & outputs and actors in a standard traditional policy implementation process.

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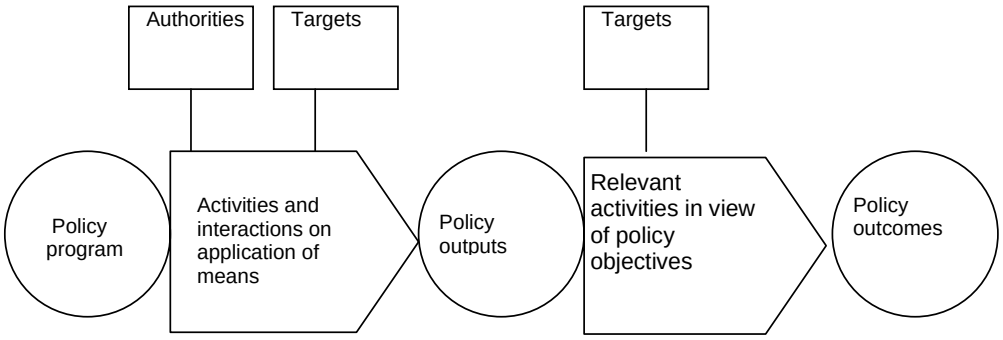

Figure 1. Standard implementation process model

2.2. An actor centered perspective in implementation

Implementing sustainability policies can be seen as a multiplicity of interlinked policy processes. These links can be serial or parallel or reciprocal and often have a multi-level character, ultimately connecting the global with the very local. Thinking in terms of policy processes suggests emphasizing their character as social-interaction processes. Doing so shifts attention from policy as a sort of production process, with semi-finished products and an ultimate end product; to a vision in which the actors participating in the process are the central concern. In modern implementation processes like many of the ones related to sustainable development, it isn't to be taken for granted anymore that 'authorities' take the lead and that 'private sector targets' follow or resist like in figure 1.

In this paper policy implementation is thus understood as a social interaction process, whereby the course and outcomes of the processes depend not only on inputs but especially

on the characteristics of the actors involved, particularly their objectives, information, and resources. All other factors that influence the process do so because, and in so far as, they influence the characteristics of the actors involved. This point holds as well for the influence achieved by policy instruments. Not all characteristics of actors, however, are determined by policy, and so it is not possible to describe a policy without paying attention to the actors involved in that policy. The relevant activities and interactions are pursued for one part by actors - organizations and people - that are officially commissioned with promoting the envisaged measures (the 'implementers'), and for another part by actors that are necessary to realize them (often so-called 'target groups'). The latter can actually also be other authorities with different main responsibilities, while the first can be private organizations too.

Obviously, it cannot be taken for granted that these other actors will have a positive *motivation* towards the employment of the envisaged policy measures. Less obvious, but still true, is that the same holds for the 'implementers'. Their motivation can be quite low, even negative. Public-private partnerships may help overcome the reluctance/hesitance in implementing policies, and initiate the spin-offs necessary for goal achievement. This happens by means of communication, by identifying each others' own goals and interests, finding strategies and spelling them out in concrete action steps that can help both categories of actors to still achieve their own goals while contributing in the same time to policy implementation.

Nevertheless, to analyze the implementation process, knowing the positions of the main actors / coalitions towards the employment of the measures (motivation) is not enough. It is not only what they want to do, but also what they are able to do. This partially depends on what information they have access to and their ability to process the *information* necessary for the (inter)actions they want to pursue. Its prominence rests on the fact that almost all of the interaction processes consists of communication. The factor of 'information' is not only about the factual availability of the information and the uncertainties surrounding it, but also the ability of the actors to gather and process this information. Hence, two types of information may be distinguished: content-wise information and process-wise information. Examples of aspects related to process-wise information are:

- the information flow across actors involved: who gets informed, when, about what, and with what consequences; the identity and roles of other actors involved in implementation;
- frequency, timing and scope of interaction among involved actors;
- information regarding 'what and how to implement': the availability and accessibility of various types of resources needed for implementation – financial, technical, permits and approvals, guidelines for investments or solution design (e.g. best practice); here the mechanisms of knowledge collection and knowledge dissemination are important;

Content-wise information regards the more 'technical' aspects of knowledge needed to implement policy, such as:

- knowledge of technologies to be used, the economics of the measures to be applied and their social or technical aspects,
- level of actor experience with the policy issue or instrument at hand, that determines the extent of learning during implementation;
- mechanisms for dealing with contestable scientific/technical information on which implementation relies (goal/objective related information, means related information, process related etc).

But information is not just an objective resource. Some informational aspects are rather interpretations of reality, which give meaning to observations of so-called 'facts'. Sufficient information is a necessary condition for activities and interactions that are really productive to employ the envisaged policy measures, even when all parties share enough motivation to do

so. When one or both of the parties actively want(s) to pursue implementation, a lack of necessary information will halt them. In any case this will be temporarily so, until they have learned enough to proceed. The rationale of public-private partnerships in early stages of implementation is often precisely to overcome the informational obstacle to goal achievement. Although sometimes a partnerships may not eliminate the informational obstacle from the first moments, having two or more actors concerned with the same issues/dilemmas is more likely to speed up the learning phase.

Next to motivation and information, implementing actors also need to have *resources* to engage in actions to achieve policy goals. The capacity to act in accordance to the role an actor decides to play in the interaction process depends on the actor's resources, in relation to the resources demanded by the preferred action. (Bressers 2001: 49). For policy implementation, all kinds or resources can be relevant: physical goods (buildings and other equipment), skilled people, money, legal/administrative permits, authority & trust (Klok, 1991). Next to the directly available resources, also the resources that can be mobilized indirectly from the networks associated with the actor are important. In this way also other actors in the network than the ones directly involved in the process can enter the analysis. As a checklist to assess these resource Table 1 may be taken into consideration.

Table 1. Assessing resource capacity for policy implementation.

Resource estimates	**Reputation based assessment**	**Resource based assessment**
Networks & actors	Support from background actors	Resources from background actors
Perspectives & goals	In tune with present understanding	Linked with stated (wider) policy goals
Strategies & means	Image of strength of policy means	Rights and demands by instruments
Resources for application	Public respect for policy / target sector	Money, secondary rights etcetera

In Contextual Interaction Theory (Bressers & Dinica 2003, Bressers 2004) all these factors - motivation of actors, the information held by the active actor(s) and the resources of actors - are simultaneously drawn into the analysis. The values on these factors together form the direct context of the implementation situation and predict the type of interaction between public actors and target groups, based on a two actor model. Based on this, hypotheses are formulated regarding the policy outputs in two-actor implementation circumstances. This theoretical perspective does not deny the value of a multiplicity of possible factors, but claims that their influence can best be understood by assessing their impact on the motivation, information and resources of the actors involved.

As a further elaboration of the Contextual Interaction Theory, the theoretical approach proposed in this paper analyzes implementation as actions performed by public agents and target groups *jointly*, by means of public-private partnerships. This takes actor characteristics as point of departure for the analysis of drivers for partnerships' formation. We argue that the emergence and dynamics of PPPs can be best understood by looking at the motivations (own goals) of actors, the information-related drivers, and the resource-related drivers. In the next section we elaborate on the issue of types of implementation activities, in order to more clearly position our discussion of the role of public-private partnerships in the achievement of policy goals.

2.3. Types of implementation activities

As mentioned earlier, the conceptual distinction between policy formulation and policy implementation (proposed by De Leon in the 'stages heuristic' of the policy process) is difficult since policy formulation basically seems to happen throughout the entire policy process. We support the argument of Hill and Hupe (2003: 8) that "What is needed is a way of combining the analytical benefits offered by the 'stages' model with the recognition of the interaction between the stages." They propose to use the term 'policy-making' for the process as a whole, 'policy formation' for the early part of policy-making, and 'policy implementation' for the latter part of the policy-making process. We find the idea useful and propose to take one step further, namely to propose a way to conceptualize an event in the policy process as suggested in Figure 2, depending on the amount of policy-making performed during implementation activities.

Since implementation activities may be very complex in terms of what types of activities are done with what aim/effect and by what type of actors, we find it useful to conceive of implementation as *a mixture of activitie*s. We propose to differentiate two types of policy implementation activities that may take place sequentially or in parallel: policy-making and policy operationalisation. Clearly not all policies come 'fully designed' at the end of the policy formulation process. Policy formulators may delegate - explicitly or implicitly - other actors to 'finish the job' of policy specification. When political/judicial actors do not complete the design of policy by specifying the policy goals, policy means and schemes[1] in a way that implementing actors are able to work with, the policy-making process continues in the 'implementation stage'. The actors involved in shaping the implementation process and arena further may be politically elected at national/regional/local level or may belong to the public administration tier of governance, or bodies in the judicial system. But policy formulators may even pass the task directly to mixed public-private agents or private actors – companies, household, NGOs, who can act on their own or through interaction with the public administration. Quite often however, this aspect of implementation takes place in networks of actors who are about to be involved also further in the policy process for the achievement of the policy program goals. We conceive of 'policy operationalisation' as being the implementation activities performed when the policy goals, means and schemes are specified in a way that implementing actors are able to work with them either directly, or by means of applying them for the local contexts (or lower levels in the chain) in which they have to operate, or for types of target groups, or types of industrial / social / economic activities, types of technologies/resources eligible, as envisaged by the policy program etc.

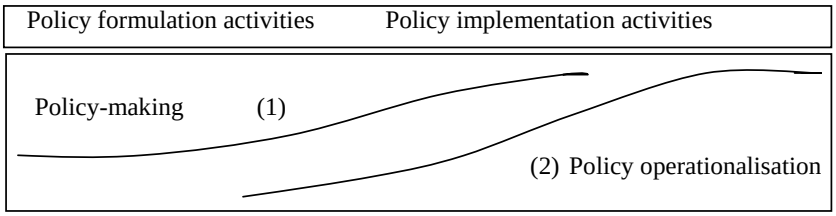

Figure 2. Types of implementation activities.

[1] We refer to 'policy means' as to the 'tools' offered for the achievement of policy goals, e.g. policy instruments (e.g fiscal instruments, production subsides, emission standards etc), resources (financial, information, human, infrastructure etc), eventually also details on technical measures, technology options or location of action. We refer to 'policy schemes' as to the institutional/organizational aspects, such as actors involved and their roles and relationships, and the policy theory to follow for goal achievement (how policy makers decided that policy goals can be best achieved: locus, timing and sequence of action of various actors pertaining to what is to be achieved).

In Figure 1, we represented by means of two curves two examples of policy program design. The space above each curve represents the amount of policy-making being done during policy formulation 'phase' and during implementation 'phase'. The space below each curve represents the amount of policy operationalisation performed during formulation and implementation phases. The upper curve is an example of policy program (1) having a shorter track of policy-making activities during the implementation phase. In this case the goals, means and schemes are in more detail specified at the moment of policy exit from the 'policy formation zone' as compared to policy program (2) following the lower curve. For this second policy, implementation involves a wider scope of policy-making activities.

Sustainability policies can often be described as 'visionary policies' or 'adaptive policies' as they often have some goals, but the schemes and means to realize them are often either yet unknown, or uncertain with still high scientific debates about them, or continuously changing as result of fast scientific advances in the field of sustainability. The policy program may be seen as best 'left open', so that implementers can be flexible when more information becomes available. This may be a frequent case in the context of fast changing circumstances and/or substantial interaction with other policy developments. But often policy formulators perceive their role as setting the direction of change in a certain industrial/economic/social field and consider that implementing actors are in a better position to specify the means and schemes of reaching the goal.

Consequently one may conceptualize the implementation process of sustainability policies as consisting of a set of policy-making activities taking place by means of a set of actors that includes policy implementers and target group actors, and a set of policy operationalisation activities that may include (self-selection of) the same set of actors. This way the policy making aspects of implementation may be seen as taking place in a network framework, while policy operationalisation may often involve public-private partnerships emerging from that network, and at a later time new private-private partnerships.

2.4 Networked implementation

When multiple organizations are involved in the implementation process, it is likely that in the course of the process they form *coalitions* on the basis of similar policy beliefs (values, cognitions) and mutual dependencies (resources). The 'coalitions' might consist of more and clearly identifiable organizations that all take actively part in the process. But it is also possible that while one or two 'representative organizations' take part in the process, these are part of larger networks of which most members do not. It is important to systematically consider these kinds of network-relation influences while estimating the value of the characteristics of the actors in the process. Basically it means that actors are playing a double game in which they are not only dealing with the issue at stake but also try to do so in such a manner that it improves their position in the network both later in the process, but also in every network that is important to them. A first observation is that actors not only interact during the implementation period, but also before and after. They are influenced therefore by the history and predicted future of these interactions. Furthermore, actors often not only interact in the process under study but in other fields as well. Also this can influence them. Thirdly, from a network perspective one should reckon that actors not only act on their own behalf, but also are influenced by background actors in the network that not actively intervene in the process under study, but still are important to the actors that do.

When estimating motivation one should not only take into account the position of the actor towards the issue involved, but also the related considerations regarding relations with other actors and parallel processes. One can for instance be somewhat negative, or rather

indifferent towards a certain issue, but go along with the other party while one want to keep good relations. Or the other way around, one can block the proposal while one is still unsatisfied with some other issue. When assessing the availability, quality and type of information in a network implementation setting, one needs to be aware of the possible impact of factors such as 'tunnel' vision and 'group think'. But also the opposite is true: new actors in the network can open-up the scope of ideas. Scientific 'epistemic' communities that are able to enter the policy network can have a considerable impact on the level were the problems are defines and measures are taken (Haas 1990). With resources one should pay attention to the possible resources that an actor that is active in the process could obtain to use from background network actors.

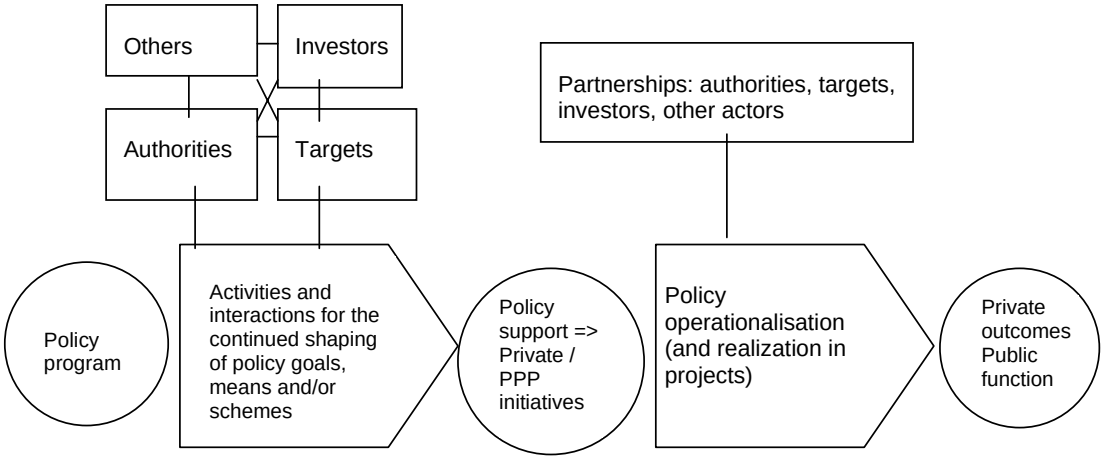

Figure 3. Networked implementation model, evolving into partnerships for policy operationalisation.

In this paper we concentrate on renewable energy technology diffusion. Policy makes use of classical 'instruments' like subsidies, in many countries. But the ultimately it takes place in what we would like to call 'project-based' implementation. In such projects, the policy operationalisation often also implies the realization of a certain investment. Here often more actors are involved than just the responsible government officials and the members of the target group(s). While in the phase of application of policy support measures these two actors will probably be at the forefront, in the second phase of project realization often not the authorities but the investors act as forefront actors in the process (Dinica, 2003). In such a 'networked' implementation setting the various relevant actors can act as fighters in an arena, but also create partnerships and other forms of cooperation (see Figure 3). During the policy operationalisation activities, the relationships between public agents and target groups often evolve in public-private partnerships, which may record various types of dynamics, as it is discussed in Section 2.5.

2.5 Relations between motivation, information and resources as sources of partnership dynamics

The actors whose activities and interactions are the contents of the processes under study are influenced by their motivation towards the initiative that is to be implemented, their

understanding of this task and its field of application and their power to act as they would want viz. a viz. other actors in the process. Whether a specific resource contributes to this power depends on the action that is at stake. Resources that seem irrelevant to get certain things done might be essential to get other things done. To some extent these factors also influence each other. To some extent they not only shape, but also are (re) shaped by the activities and interactions that happen in the process. The dynamics in the development of the partnerships are related to these three actor characteristics and the way they are influenced in the course of time.

First of all there is a set of mechanisms that increase the bonds in a well-functioning partnership as time goes by. The first mechanism is that mutual adjustment arises from the tendency of actors to act from a set of constant values. The second mechanism is that mutual adjustment arises from the tendency of actors to use a common reference frame to interpret cognition. The third mechanism is that mutual adjustment (increased dependence of actors on each other's resources) arises from the tendency of actors to concentrate on their relative strength. Of course external change drivers can disrupt such tendencies. But these 'natural tendencies' will then provide a degree of resistance preventing disturbances, because all together they build up a collective resource: trust. Furthermore, standard operation procedures and sunk costs prevent deterioration of cohesion.

Secondly there is an influence from the activities and interactions that happen in the process on each of the three main characteristics with all actors involved. Motivation can increase by positive feedback from other actors and from successes (cf. Deutsch 1968, Bressers 1989). Information, both on the contents and on the characteristics of the other actors involved becomes better learned. The growing experience and knowledge makes more efficient techniques available. The opposite might also happen. Failed attempts can disrupt motivation, let the actors perceive the possibilities in a more negative way (information), and can lead to a retreat to solitary (non) action. Mixed influences are also conceivable. Sometimes the positive feedback on one aspect (e.g. investments) can be slower than the negative feedback on another (e.g. behavior).

When mixed influences occur, a third set of influences becomes important. These are the mutual relations between the three key actor characteristics. Every change in one of the three has influences on the other two. While we typically start with mentioning motivation in this paper, many would like to start with the way reality is understood and problems and chances perceived, or some technical information is available (pertaining to technology, economics, social or environmental information), as a prerequisite for motivation. It must be born in mind that the influence is mutual: without certain interests and values, available data may be overwhelming and too time consuming to process. The development of information needs some focusing of attention. The actions for which an actor is motivated require resources, and the availability of those resources is bound to influence the actors' ambition, for instance because a lack of necessary resources creates a low self-effectiveness assessment (Bandura 1986). While 'knowledge is power' may be in some contexts an exaggeration, it is certainly true that information can serve strategic purposes and hence can be used as one of the bases of power. On the other hand gathering and processing data is also an activity that needs resources. Hence, internal (from the process) or external change drivers will set a wave of adaptations (changes) in motion that can lead to new phases in the development of partnerships.

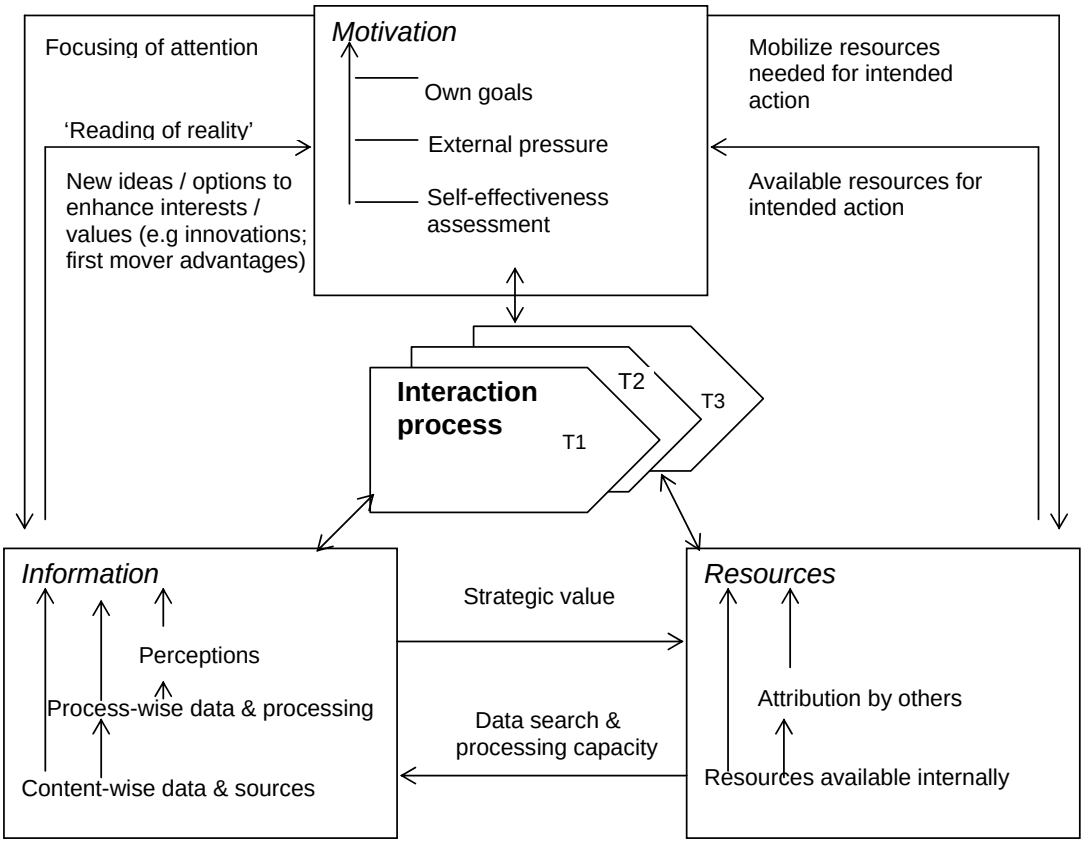

Figure 4. Dynamic interaction between the key actor-characteristics that drive social-interaction processes and in turn are reshaped by the process

The next sections of the paper presents some empirical evidence for the theoretical arguments elaborated on the basis of the Contextual Interaction Theory, for the implementation circumstances of policy operationalisation by means of public-private partnerships.

3. Empirical analyses: Experiences from Spain

This section discusses the drivers and dynamics of public-private partnerships in Spain for the market introduction of wind technology and biomass electricity technologies since mid 1980s. Furthermore it analyses the transition towards new green private-private partnerships that can ensure the continued diffusion of renewable technologies towards a sustainable electricity industry.

Partnerships are discussed from the perspective of key drivers for their formation: motivation of actors, information aspects and the needed resource structure[2]. Most often the

[2] For data collection, three main sources of information were used: written material, interviews with experts and information posted at the websites of project owners, RET service providers and public authorities. A wide variety of written sources was used: book publications, scientific articles and unpublished research reports, articles from journals of the renewables' and wind industry, conference proceedings, press releases, technical studies, the national legislation regarding renewables support and

introduction of innovative technologies necessary for the transition towards sustainability assumes "innovative relations" among actors who did not necessarily ever cooperated previously. This was also the situation in our empirical cases, where except for the relationship between public authorities and energy utilities, there were no relations between the 'would-be partners' before the political decision was made to introduce renewable energy technology in the electricity industry. Because of this, partnerships for policy operationalisation may be difficult to establish and maintain without some form of public support.

Empirical research suggests that, with regard to the greening of electricity industries, the three categories of key drivers behind partnerships formation take the following forms:

- Motivation - goals / interests / values of actors:
  - national political goals;
  - regional political goals - social, economic, industrial;
  - commercial interest;
  - strategic goals - technology learning, setting example for others;
  - environmental goals/values;
  - community values: use of indigenous/local resources;
  - prime-mover advantages in a new market;
  - use of self-generated electricity (self-sufficiency).
- Information related drivers:
  - (content-wise): actors need to learn together - about technology, resources - or contribute to knowledge development that may be made available more generally;
  - procedural (process-wise): actors need to learn how to conduct business and develop the administrative and operational phases related to renewable energy generation (or industrial process or other activity related to sustainable development).
  - Cognitive / interpretations of reality: actors develop jointly ways of interpreting crucial aspects surrounding their investment decisions, such as the risks associated with political support and the legal framework for price support.
- Resource related drivers:
  - complementarity: resources are either missing/incomplete, in which case there is a situation of actor interdependency; or
  - synergies: actors have the necessary resources but could gain (much) more by pooling resources; this can also be beneficial for sustainable development since this leads to faster and more substantial greening of electricity supply.

The analyses in Sections 3.2 and 3.3 look at the formal types of partnerships: joint ventures for investments in wind and biomass electricity projects. Before engaging in partnership analyses we make, in Section 3.1, a short introduction into the features of price support programs implemented by the Spanish government since mid 1980s for the support of renewable electricity technologies.

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policy documents, country overviews and energy data bases of governmental and European Union bodies, company and organizational internal documents (e.g. overviews of investment activities, project specifications, project evaluations and annual reports, promotion material from manufacturers). Extensive structured interviews were conducted during 2001 and 2002 - face to face, by telephone, by e-mail and fax. The questions concerning the motivation and resource complementarity/synergy were mostly addressed in face to face and telephone interviews, such details are seldom available in written material and quite difficult to collect in practice. Due to the dispersion of companies and investors across country and the company-specificity of the required information, e-mail and fax communication was a rich source of information. In companies, most interviews were carried out with the investment directors/managers or the financial directors.

3.1. Policy support for the greening of electricity industry in Spain – milestones and results

Spain has been one of the countries with the highest dependency on imported energy resources in the European Union. Hit hard by the oil crises of the 1970s, the Spanish government embarked into a new energy policy, aiming among others to promote domestic energy resources of any types no matter the costs. Given the absence of domestic gas resources and poor presence of low quality coal, renewable energy resources became a political priority that remained on top of the agenda until nowadays, in spite of substantial changes in the political colors of the government and parliament. From mid 1980s up to the end of 2000, four Renewable Energy Plans were adopted, allowing for investment subsidies for renewable energy technologies. Next to these, legal instruments were used as well to guarantee the purchase of renewable electricity. Three legal frameworks can be differentiated since 1980.

The first legal framework: 1980-1994. From 1980, the development of renewable energy in Spain was protected by three major legal guarantees: network connection, purchase contracts with utilities, and guaranteed price. They were first introduced by the 82/1980 Energy Conservation Law. The price was not specified in the law but was set annually by Order of the Ministry of Energy and Industry. Price design was assessed by developers as posing high risks (Dinica, 2003). Although there was a governmentally guaranteed demand for the purchase of renewable electricity, contract length was not mentioned in law. This meant high contract risks for financing agents.

Investment subsidies were also used to improve the economic attractiveness of RET projects. However, while wind technology was often generously subsidized, biomass electricity technologies have received no investment subsidies as they were considered not sufficiently mature for market entry. For wind energy, the government agency Institute for Energy Saving and Diversification (IDAE) also resorted to equity participation in RET projects and 'third party financing', in order to encourage various economic actors to enter this business sector. For biomass technologies these two financing interventions have started to be used only in the second half of the 1990s. During the 1980s and early 1990s, public financial support was very generous for wind technology, enabling project profitability in the range of 10% - 20%, depending on resource location and quality. However for biomass electricity projects were not commercially profitable.

The second legal framework: 1995-1996. In 1994 a new electricity law was adopted, strengthening the special protection regime for renewable electricity. For the first time, the guarantee on purchase contracts was specified for a minimum period of five years, reducing contract risks to the issue of renewal after the first five years. The new law envisaged that prices were to be set by means of governmental Royal Decree – also reducing price risks, in the perception of prospective investors. These changes created an atmosphere of investment interest among a large variety of economic actors. For wind technology, investment subsidies have already started to be phased out in 1995, because factory technology costs lowered, but public support still enabled projects with good profitability: 10 – 15 %. For biomass, investment subsidies started to be applied with more frequency since 1995 and projects using secondary biomass resources (i.e. organic wastes, from biomass already used once in various kinds of applications such as wood industry, food/agro industry etc) became profitable, but mostly in niche markets.

The third legal framework: 1997-present. The main legal instruments setting the governmentally guaranteed trade arrangements are the 54/1997 Electricity Law and the 2818/1998 Royal Decree. Generators using RET plants below 50 MW are granted a 'special regime', which offers:

- the right to network connection;
- standard five year purchase contracts with the grid electricity company; and
- a certain revisable price per kWh adopted by the government by means of Royal Decree.

The Decree offers two payment methods under the special regime, at the choice of generators. The first is a 'market-based' option, and the second is a 'revisable tariff' option. As regards purchase contracts, there is still no explicit guarantee on renewal after 5 years. However, by early 2002 there were yet no conflicts regarding contracts' renewal. For wind technology investment subsidies have been almost phased-out – with the exception of small projects and/or small developers, but still the average profitability potential remained high – above 8 %, making wind investments interesting for many types of economic actors. The profitability of biomass electricity projects has slightly improved making plants using primary biomass (clean resources such as forest wastes, purpose grown energy-crops) occasionally profitable. But the profitability of biomass electricity projects remains dependent on investment subsidies as the price support in the legal framework is still much too small.

Diffusion results for wind technology were very large by 2000, with 2900 MW installed or in construction phase in the period 1995-2000. In early 2004, the installed capacity was slightly over 6200 MW (Source: www.appa.es). For biomass electricity technology, the same legal framework of support was applicable during the entire 1980s and 1990s (i.e. same types of policy instruments). However, the extent of price/financial support was very different. Given non-profitability before 1994, only industrial companies and agricultural cooperatives interested to dispose of biomass wastes in an environmentally-friendly way or use them for self-generation purposes, invested in biomass electricity plants. Between 1990 and 1994, 78 % of biomass electricity capacity installed was used for self-generation purposes[3]. Only 21 MW of biomass electricity plants were built during 1990-1994. In the period 1995-2001, the support system for biomass allowed only for low/modest profitability while since 1998, occasionally, a capacity increase of 433 MW was recorded, which can be seen as a modest increase in the biomass power base.

Both in the case of wind energy and biomass projects, partnerships are responsible for a substantial part of the projects commissioned. PPPs initiated the first projects and have been so far the most popular form of investments in Spain for both types of technologies. Sections 3.2 and 3.3 discuss the drivers behind partnership formation, actor roles, and the dynamics of partnerships types and structures that lead to the recorded installed capacity increase.

3.2. Partnerships for wind electricity projects in Spain

The renewable energy agency of Spain IDAE (Instituto de Divercificacion y Ahoro de Energia) has been always very committed to wind energy promotion. Given its financial autonomy, it played a crucial role in initiating investments in wind power plants. Beside the traditional policy instruments (investment subsidies and soft-loans, used by most European energy agencies) the renewable energy agency was original and effective through the use of partnerships by means of joint ventures with various type of actors*:* private companies, local/regional authorities, research/academic institutes, farming companies and cooperatives (for biomass). In principle, more types of partnerships can be differentiated in the filed of wind energy in Spain, depending on: the type of financing, the type of activity, and the type of investment.

From the standpoint of financing, one form of partnership was that based on the 'third-party finance' formula, and the second was done through its direct capital participation in companies specialized in renewable energy investments. By engaging in this type of support,

[3] No governmental data are available regarding biomass electricity projects built during the 1980s and no project owners could be identified, who built plants during the 1980s.

"Idae tried to find out a replicability effect to speed up private investments to obtain an economically sustainable renewable energy market" (Concha et al. 1996). Partnerships in wind energy focused on three types of activities:

- technology development and demonstration
- technology early-stage commercialization
- technology large-scale commercialization.

Aside from the type of financing and type of activity, partnerships can also be differentiated per type of investments:

- 'project-vehicle partnerships' which means that the joint venture is exclusively focused on the respective wind project and have no other economic activities under the same formula;
- 'wind-specialized partnerships': the same joint venture is making investment in more projects and sometimes has large investment strategies covering an entire Community Autonomous, more Communities or the entire country;
- 'renewables-specialized partnerships': the same as wind-specialized companies, but with activities in other renewable energy technology investments as well.

A very important factor that makes partnerships so widespread and so successful in Spain is *the business culture of economic actors with regard to risks* (hence a culturally grounded motivational factor). Many economic actors are not flexible to accept risks – technological and/or economic and/or legal - in the support system. They prefer clear signals for long term political commitment for renewables, the involvement of a public agency – be it very small (like 2-5 % ownership), and the involvement of influential corporations viewed as opinion makers in business.

3.2.1. Motivation, information and resource aspects underlying the formation of partnerships for wind electricity projects in Spain

The drivers for partnerships need to be discussed for the different types of partnerships empirically identifiable, as well as from the standpoint of the various types of actors involved. A public actor that has been constantly present in PPPs during the market introduction of wind technology and a substantial period of time during the diffusion of this technology is the governmental agency IDAE. From the IDAE perspective, the following motivational drivers have been identified as common to all *types of partnerships IDAE joined in the wind energy field:*

- promoting fast and qualitative development of national manufacturing industry for wind technology that should be competitive internationally (policy goal shared by industrial and energy companies);
- creation of jobs through establishing a new industrial sector (policy goal shared by industrial and energy companies; local and regional authorities);
- regional development due to the localized nature of renewables (policy goal shared by industrial and energy companies; local and regional authorities)
- reduction of the serious dependency on imported oil (much higher than the average in EU)
- RET as contributing to climate change mitigation
- concern for the environmental and health impacts of fossil and nuclear energy technologies.

These are chiefly motivational factors pertaining to national and regional political goals, and to environmental values. But next to this, various other drivers counted also for the initiation by IDAE, or joining, of each type of PPP differentiated. These 'other drivers' also describe the other actors involved in PPPs. Looking at PPPs from the standpoint of their *type of*

activity, the following findings emerged.

PPPs for wind technology development and demonstration

PPPs with this type of activities emerged in mid 1980s for wind technology in Spain. The main actors – and for most of the time up to early 1990s the only actors – involved were IDAE and energy companies / technology manufacturing companies. The main drivers were:

1. Content-wise Information - pooling technical expertise and strengthening the basis of information. The need for content-wise information played a more important role in this stage, which means learning about the technicalities of the projects.
2. Motivational factors (own goals):

IDAE was interested in motivating others by:

- giving a political signal that governmental support for wind energy is reliable and long-term oriented;
- speeding up national technology development having in view the expected international competition for wind technology manufacturing.

Wind manufacturing companies has an obvious commercial interest in developing an industrial sector with governmental support – where they would have market power; energy companies also has a strong commercial interest in becoming prime movers in green electricity production; some utilities understood early that renewables are a 'sink or swim' issue and agreed that if there is a market for renewables they want to be involved.

3. Resource complementarity: pooling together the internally available financial resources (own capital or corporate/private finance loans) - in early phases technology was very expensive per kW installed capacity.

PPPs for early-stage commercialization of wind projects

For this type of partnership, we noticed an important role of resource complementarity for joint venture formation as well as cognitive aspects that is helping economic actors and society learn about a new technology. IDAE was a frequently recurring actor in PPPs for early-stage commercialization of wind projects. Main drivers behind this type of partnerships were identified as:

1. Motivational factors (own goals IDAE):

IDAE was interested in motivating others and changing perceptions by others, by:

- giving a political signal that governmental support for renewables is reliable and long-term oriented;
- improving technology perception among potential investors[4] and stakeholders (the fact that renewable technologies work, do not break down and can give constant profit => cognitive dimension / content-wise information)
- improving the legal risk perception with regard to the price support system: as mentioned in Section 4.1, there were risks for investors embedded in the legal support framework as a result of faulty legal design, in spite of political commitment.

2. Resource complementarity: overcoming the financing obstacle. Some companies where willing to

invest but did not have the financial resources to do so. Banks were reluctant to give loans to actors that have not been involved in the field of energy production before, or who have not used the respective type of technology before. Banks would agree to give loans either only to

[4] Companies that could have been potential investors did not trust the technology either because they were not familiar with it or because it was not used it before (the respective design) in Spain; when a public agency was involved, their confidence to invest in RET projects increased.

publicly-backed companies or for projects where a public agency such as IDAE was involved also financially.

3. Informational: overcoming the obstacle of limited technical expertise of potential owners, both in

project development and project operation. There were yet very few companies offering technical assistance. There was still a need for technology learning as new actors were attempting to work with it. Consequently both content-wise and process-wise information need constituted drivers for such partnerships.

Regional and local authorities were being increasingly interested and involved in partnerships for early-stage commercialization of wind projects with various types of economic actors. But, next to public-private partnerships, in mid 1990s the first new private-private partnerships dedicated to individual wind projects emerged (hence also project-vehicle partnerships). The above mentioned drivers of resource complementarity and informational aspects were also the main reasons for the emergence of private-private partnerships and for the partnerships between various types of actors and regional/local authorities. In addition, the motivational factors that contributed to partnerships have been identified as:

For regional/local authorities (own goals):

- socio-economic benefits at local/regional level
- attracting companies in the regional for industry development

For economic actors (own goals):

- prime-mover advantages in a new market;
- combination of self-generation interests and commercial interests[5]
- local business opportunity
- perception of lower economic risks for investors due to faults in the legal support framework, when a public authority was co-owner of the wind project.

PPPs for large-scale commercialization of wind projects

For this type of partnership, we noticed an important role of resource synergies and motivational factors for joint venture formation. Although IDAE remained involved in commercialization, its partnerships are not dominating any more the investments in wind projects. The key drivers for such partnerships have been identified as:

1. Resource synergy: pooling together various types of resources to be more successful in the increase-

ingly tough competition between the very many interested investors. There is the strong interest to increase the financial pool underlying investment plants, in order to get an as big as possible 'pie-share' (maximize the MW installed in the total governmentally subsidized capacity[6]). But, next to money, resources of many types are pooled: land, workforce, technology, lobby potential, etc. For example, manufacturing companies that already achieved large economies of scale in technology production can bring-in low cost technology for the partnership project(s). When regional / local authorities are co-owners this makes permitting easier. Another resource benefit is a more powerful lobbying group: actor diversity in a partnership means also that investors are stronger in negotiating with the government about maintaining or improving the legal-financial framework for renewables support. Although it is a governmental agent, IDAE has often been "on the investors' side" in the struggle for financial resources with other national departments and ministries.

[5] There were projects that had as main purpose the de desalinisation of water; when plants were not temporarily used for this purposed, the owners were selling wind electricity to the local energy utility.

[6] The governmental target for 2011 is 13.000 MW and many partnerships were making investment plans for thousands of MW; by 2002 the competent permitting authorities received investment plans that totaled 40.000 MW capacity at national level (Bustos 2002). The likely grid integration ceiling is considered to be 30.025 MW.

2. Motivational factors (own goals):

For economic actors:

- commercial interest dominating
- for some: local business opportunity
- for some: the environmental benefits of a profitable investment opportunity and/or community values.

For local/regional public authorities/agencies:

- enhancing socio-economic benefits at local/regional level
- attracting companies in the regional for industry development .
- local business opportunity: income additional to budget financing.

3. Information aspects: 'reading of reality'.

- Interpretation of governmental price support and confidence in it: Since mid 1990s, the ideology

emerged in Spain that the legal premium/tariff received by RET investors is not a 'subsidy' (which could have been challenged with withdrawal due to "competition rules") but an internalization of the environmental benefits and system benefits of renewable plants. This has also been stated in the 54/1997 Law and 2818/1998 Royal Decree. This approach to price support was reinforced in the last years of the 1990s by EU authorities and contributed substantially to the way developers and financing agents assess price risks.

- Confidence in policy continuity: although interviewed actors have different expectations and

prognoses with regard to how the support system for RET would look like if the government would like to change the current instrument[7], there is a widespread perception that renewables will continue to be supported anyway. The prolongment of governmental support for renewables is expected for reasons related to security of supply and resource diversification needs, lowering social tolerance over the environmental and health impacts of fossil and nuclear energy technologies, and expected increasing evidence of climatic changes[8].

3.2.2. Dynamics of partnerships and actor structures during wind technology diffusion

Up to mid 1990s almost all wind project partnerships had the involvement of IDAE, under the formula 'project-vehicle joint ventures'. Between 1990-1994 project-vehicle partnerships were responsible for around 80 % of the wind capacity installed during these years (Dinica 2003).

Since early 1990s, more actors started to join the PPPs as equity investors, such as regional governments and water utilities – next to energy utilities and/or wind turbine manufacturers. Consequently, the actors involved in partnerships for technology development and demonstration can be divided into five groups:

1. the governmental renewable energy agency IDAE;
2. manufacturers of wind technology (Made[9] and Ecotecnia);

[7] Some developers argued that the bonus/tariff will be available at least until 2005, when the EU plans to decide on a harmonized support systems for renewables. At that moment other countries and EU authorities would realize that the price support system used in Spain, Germany and Denmark has been the most successful for the market development of renewables and would continue to back it up. Even if after 2005 a special bonus or tariff will not be available anymore, there is very high confidence that there will be a similarly attractive system to continue stimulating renewables market diffusion (Lopez C., Arrieta J., April 2001). Others assume that the current special regime support will last at least until 2007, when the liberalization of the entire segment of consumers is scheduled in Spain. Currently all expenses related that the guaranteed bonuses and high-tariffs for renewables are falling on the electricity bills of captive consumers. (Utrillias; Lopez, Castillo, 2001). And others expand the time horizon of their expectation for special regime protection to at least the year 2010 when the 12 % target of renewables contribution to Spanish energy consumption should be reached (de Rojas Barcona, Fernandez, Bustos).

[8] Franco del Pozo, Endesa EyC, April 2001; Arrieta J. EHN, April 2001; Mendilluce M. IberRenova, May 2001.

[9] Made was a public company and subsidiary of the largest energy utility Endesa. In 1989, research and development (R&D) work started in wind technology. The attractive part of the R&D program of Made was that all costs were passed over to consumers through the electricity tariffs as a 0,3 % charge. In 1999 Made split away from Endesa and was re-named Made

3. energy companies: at that time they were still called energy utilities (Endesa and Union Fenosa) and
4. to a lesser extent water utilities (in areas with water desalinization challenges); and
5. regional and local authorities.

However, not all actors were involved simultaneously in each partnership. This happened in the commercialization stage (especially early commercialization) when the number of actors forming a partnership increased.

The period of early stage commercialization of wind technology can be approximated as 1994-1996. *In this period a transition can be observed, from project-vehicle partnerships towards wind-specialized partnerships and renewables-specialized partnerships.* This suggests an increased confidence of investors in wind technology in particular and in renewable energy technologies (RET) in general, since they dared to focus a large chunk of their financial, human and technical resources in wind/RET projects.

A striking characteristic of the project-vehicle partnerships related to early-commercialization activities is their composition: almost the same type of actor in each partnership, each fulfilling a clear role:

- there was a bank or another type of financing agent securing the necessary loan;
- a regional/local authority securing the necessary administrative permits and social approvals
- IDAE with direct equity investment[10];
- a manufacturer supplying the technology with guarantee for technical quality, sometimes at costs lower than on the market;
- an energy utility offering guarantee of grid connection and other network related issues (who was often also the legal buyer of wind electricity, hence eliminating the contract risks induced in the legal framework of support)
- sometimes also the land owner has an ownership share in the wind plant, which is preferred by financing agents;
- eventually another local/regional agent that could bring extra benefits to the project.

Almost all project-vehicle partnerships in Spain have this actor formula. This emphasizes the crucial role of resource complementarity in the formation of partnerships for early-stage commercialization.

When wind-specialized partnerships and renewables-specialized partnerships emerged, they displayed largely the same actor formula with the main differences that:

- IDAE was not involved in such partnerships. IDAE can function as a commercial company or in a commercial formula, but it is in the same time the renewable energy of Spain and cannot have renewable electricity production as its core activity. Its main institutional goal was to promote the commercial production of renewable electricity. IDAE's activities were supposed to set an example and to generate spin-off; but by becoming a permanent commercial producer it would have overreacted to its goals.
- Large industrial corporations from a wide variety of sectors entered the wind generation business and there was almost no such partnership without an industrial corporation.

The large-scale commercialization of wind technology has taken place predominantly by means of wind-specialized partnerships and renewables-specialized partnerships, which represent the transition from public-private partnership (with the exit of IDAE) to new green private-private partnerships (with the entry of all the diversity of new economic actors).

Energias Renovables (Lara 2002). By 2000 Made developed many technological designs and held a 10.5 % market share in Spain.

[10] Although in the second half of the 1990s its presence was not really necessary anymore since the spin-off has been already created, IDAE continued to invest also as part of its self-financing strategy.

According to our calculation (Dinica 2003: 264) wind-specialized partnerships and renewables-specialized partnerships were responsible to 60 % of the capacity installed between 1995-2000 (of 2900 MW), represented by 85 projects, while project-vehicle partnerships accounted for 36 % of wind capacity investments, represented by 48 projects.

Another transition has been observed is the shift of public-private partnerships investing based on internal financing schemes[11] - that is the own cash resources and/or loan power based on marketable assets of project initiators - to PPPs able to secure project finance loans - i.e. where the wind project itself represents sufficient guarantee for loan reimbursement. Up to 1994, internal financing schemes were the rule for investments, since banks trusted neither the wind technology not the political commitment and legal framework of support sufficiently. The most used approaches were third-party finance by IDAE, multi-contribution finance (several actors pooling equity/cash), in-house corporate finance (the available cash of a single company), and debt-corporate finance (loan guaranteed with the marketable assets of a company).

The years 1995-1997 were a period of transition from internal financing schemes towards project finance. In these three years 14 of the total 34 projects commissioned were based on internal financing schemes. Since 1998, project finance is the dominant financing approach used by large developers. From the total 168 projects built and under construction in the period 1995-2000, only 28 projects were based on internal financing schemes (Dinica 2003: 268). The availability of project finance loans means that the financial pool on which the diffusion of wind (other renewable) technology can draw is substantially larger and a more significant shift towards the greening of the electricity industry may be expected. Besides, this allows in theory a larger diversity of economic actors to enter the industry of renewable electricity production offering higher prospects of socio-economic-industrial embeddedness of the new sustainable technology.

3.3. Biomass electricity projects in Spain and the role of partnerships

Before discussing partnerships and diffusion, it is necessary to clarify their object: the biomass technology. The technological approach of harnessing biomass energy to transform it into electricity assumes is not as straightforward as in the case of wind technology. Four technological principles for biomass-to-electricity conversion have been developed so far: combustion, anaerobic fermentation, gasification, and pyrolysis. The first two are quite old, mature technologies. Therefore partnerships using them can only be found in the category ‘large-scale commercialization’.

Gasification technology[12] is in demonstration phase in many countries, and some experts consider it very close to market deployment, with efficiencies of 45-50% considered achievable in a near future. Pyrolysis technology[13] is in 2004, still at the border between development and demonstration, and the efficiency ranges are yet unclear. Therefore, partnerships using gasification and pyrolysis technologies regard mainly ‘technology development and demonstration’ and ‘early-commercialization’.

Furthermore, in contrast to other technologies, in the case of biomass the discussion on technology needs to be made in parallel with the specification of resources employed. So far electricity has been produced from the so-called ‘secondary biomass resources’ - that is organic wastes from various industrial/agricultural applications, landfill gas and biogas.

[11] In the group of internal financing schemes we differentiate among: private finance, participation finance, in-house corporate finance, debt-corporate finance, third-party finance, and multi-contribution finance. For more details see Dinica, 2003: 106-118.

[12] Gasification technology assumes the transformation of biomass, at high temperatures, into combustible gases and a solid by-product called charcoal.

[13] Pyrolysis technology is the transformation of biomass into combustible oil, having as by-products gases and solids - also combustible.

Secondary resources incur no or low costs, e.g. the transport from waste production place to waste-use-for-energy place. But sometimes they also bring negative costs, when the waste producers incurs higher costs to get away with them in an environmentally friendly way, and prefer to pay some economic agents to pick them up and use them. Combustion and anaerobic fermentation technologies have used so far overwhelmingly secondary biomass resources, and these combinations of technology-resource can be safely categorized as 'large-scale commercialization' investments. Given the insufficient price support in the Spanish support system, all biomass electricity projects built up to 1995/6 used these mature technological designs and secondary biomass resources.

Primary biomass resources are considered to be forest and agricultural wastes, energy crops, as well as industrial and agricultural organic wastes that have not been used in any way previously. They may be used as resources for all four types of technological designs. Many actors, both companies and public agents consider projects using primary biomass resources as 'innovative energy systems'. This can be indeed seen so when primary biomass is used as input in gasification or pyrolysis technologies. However, when primary biomass is used in combustion technologies or anaerobic fermentation, their qualification as innovative is mainly motivated by the interest to make them eligible for investment subsidies. We will consider such projects in this study as 'early-stage commercialization' investments.

No public-private partnerships for biomass electricity projects emerged in Spain before 1995. More than three-quarters of the installed capacity was serving self-generation purposes, by 1995, and was owned by individual production companies[14], and small agricultural farms/cooperatives generating organic wastes in their core production activities (Dinica, 2003: 320-324). The surplus electricity was being sold for bilaterally agreed un-transparent contractual prices. There were no demonstration projects based on gasification or pyrolysis technologies in the private industry sphere. In Spain only some universities were involved since late 1980s in fundamental research on these technologies. But there was no cooperation with the industry until late 1990s (Fernandez Jesus 2002). Research activities remained exclusively in the public sphere until late 1990s (Arauzo Madrid 2000) [15].

The main reasons why PPPs did not emerged up to mid 1990s pertain to large extent to the resource aspects underlying partnership formation:

- Financial incentives/resources:

- Insufficient governmental price support (when projects are not profitable, joint ventures would hardly emerge)
- IDAE prioritized its support in terms of financial involvement: first wind technology - considered closer to market-performances, and later biomass electricity and solar photovoltaic; IDAE has a running capital for energy investments but this is limited and setting priorities was seen as the only way it could meaningfully help all technologies.

- Biomass resources: the biomass resource market was yet not organized; this regards especially the primary biomass resources; a high risk existed but built plants would face intermittencies in resource supply.
- Content-wise information: the more efficient technology designs of gasification and pyrolysis were considered still in need for demonstration and improvements, both by IDAE and many types of economic actors – potential investors.

[14] The industrial sectors where most projects were realized were those of: pulp and paper, followed by industries of food, drinks, wood and wastes management (Era Solar, 1997, interview Fernandez Jesus [ADABE] April 2002).

[15] In 1988 the first Spanish demonstration project for gasification was initiated at the University of Zaragoza. The project was financed by Idae, the national energy research center CIEMAT and the regional government of Castilla y Leon. The "down-draft technological design was tested. In the 1990s the number of RD&D projects for gasification at universities increased and several departments also expanded towards pyrolysis technology.

PPPs have emerged since 1998. However, by 2003, they still played a very modest role in diffusion, as compared to wind technology diffusion. In the database of IDAE, 74 projects were listed as commissioned in the period 1996-2001, and benefiting of price support from the legal framework. Of these we differentiated as follows:

- 1 project as 'technology development and demonstration' public-private partnership, for the demonstration of gasification technology, with the involvement of governmental agency IDAE (27 % equity; in partnership with corporation Taim-Tfg. This very small size project – 0,6 MW – was in construction phase in 2002;
- 2 projects as 'technology development and demonstration' investment, by a private company, for the demonstration of gasification technology
- 5 projects as 'early-stage commercialization' public-private partnership using primary biomass resources with mature technological design, with the involvement of governmental agency IDAE. The first such project was put into operation in 1998.
- 12 projects as 'early-stage commercialization' investments, each by either private company or a PPP with a regional authority/public company, or a new green private-private partnership, using primary biomass resources with mature technological designs;
- 1 project as 'large-scale commercialization' public-private partnership, based on third-party financing by IDAE for an industrial company, using secondary biomass resources with mature technological designs.
- 54 projects as 'large-scale commercialization' investments, using secondary biomass resources with mature technological designs.

Next to these there were:

- 9 projects as 'technology development and demonstration' investment, each by an individual private company, for the demonstration of gasification technology. These 9 projects were not listed in the IDAE register.

Interviews with market experts pointed out that a number of 'large-scale commercialization' investments' have been developed as public-private partnerships with regional authorities and/or regional energy agencies and/or public companies for regional development, (without the financing involvement of IDAE). An example is the joint venture Biosasiesta, with the involvement of a regional energy agency. The number of such PPPs could not be established because the actor participation in such joint ventures if not transparent. These PPPs belong to the category of 'project-vehicle partnership', just as all the above mentioned PPPs with the IDAE involvement.

However, the majority of the 'large-scale commercialization' investments' that were not made under PPPs, were made by individual private companies. Several new green private-private partnership**s** also emerged after 1998. Some are 'project-vehicle partnerships', such as Biomasa de Extremadura, Biomasa del Pirineo, and others are biomass-specialized partnerships. e.g. Oleicola Tejar[16]. Many of them have the involvement of an electricity company. By 2002, no investments were done exclusively by renewables-specialized partnerships.

Consequently, in the period 1996-2001, only 7 PPPs have been identified with IDAE involvement. They represent together 64,5 MW, that is only 15 % of the installed capacity increase recorded in these period. It is important to note that PPPs with IDAE emerged actually quite late: all 7 projects have entered into operation beginning with 1998. Another note is the focus of IDAE-linked PPPs: while in the case of wind technology the overwhelming majority of projects qualified as 'technology development and demonstration' had the equity participation of IDAE, in the case of biomass, only one project belongs to this

[16] This is a partnership made up by the olive processing cooperative Oleicola el Tejar with the regional grid company Sevillana and the large technology corporation Abengoa.

category. The development and demonstration of gasification and pyrolysis technologies has taken place in separate arenas:

- public arena, where several universities conducted research, some independently, other in cooperation with publicly funded energy research institutes – national or regional, and
- private arena, where several large industrial corporations developed projects to test their own designs or imported designs of gasification technologies.

Five PPPs with IDAE are 'early-stage commercialization' investments with primary biomass resources and one regards large-scale commercialization of secondary resources with mature technological designs.

Next to these there is an unknown number of PPPs with the involvement of regional public actors. Interviewed market experts explained that PPPs developed as project-vehicle partnerships are characterized by the following a*ctor structure:*

- one public agency/company, often helping with the administrative approval processes and local-social acceptance/engagement; these are typically regional energy agencies, and public companies of regional government aiming to promote regional economic development;
- one electricity company providing the link with the electricity industry;
- one large technology corporation taking care of plant construction and/or operation;
- one company that supplies biomass resources, and sometimes;
- one financial institution, taking care of a good loan arrangement.

These looks highly similar to the actor structure characterizing partnerships for wind technology[17]. Nevertheless, the majority of projects were large-scale commercialization investments, commissioned by individual companies or new green private-private partnerships. In the following paragraphs we discuss the motivational factors – pertaining to 'own goals' – underlying the involvement of the various types of actors in biomass electricity projects.

The public actors have two strategic interests. On the one hand, they try to build confidence in biomass electricity technologies serving as example of successful developers, as they are interested that many projects are located in their region, to boost the economic-industrial development. On the other hand, they try to create employment in the region and raise the interest of local people in biomass production and use,, in the context of declining employment in agriculture. Next to these public actors are also interested in the commercial – profit gain – aspects of biomass projects.

Energy companies and large industrial technology corporations entered the market first with projects having a technology/resource demonstration component. They mainly tested new biomass resources - clean forestry wastes, clean agricultural wastes, and energy crops. One interviewee (Carrasco 2002) mentions that some of these companies have also social motivations to invest as well, related to raising interest of local people in biomass, towards building networks for resource supply. Another demonstration line involves the testing of the gasification principle. Almost all these projects benefited of investment subsidies from the government, EU programs or/and regional administration.

In addition, this group of developers also built large-scale commercialization plants using organic wastes or biogas in conventional direct combustion technologies. The number of commercial plants developed by them increased after 1998, with the adoption of the new support system, when the terms of contracts and price have become clearer. But their commercial plants also have a clear strategic component. The strategic driver to invest is given by the expectation that government would approve the budgets envisaged in the 1999

[17] Small developers are likely to enter partnership when they can provide something, most often biomass resources. The technical complexity and large economies of scale of biomass electricity technologies are serious obstacles for them to invest alone.

policy plan for subsidies and fiscal advantages. This would considerably enlarge the segment of economically feasible resource potential. In addition, it is expected that the special price based on the 2818/1998 Royal Decree would also increase, because otherwise the fulfillment of the 12% target would be compromised. It is important therefore that when the market gets momentum, this can find companies with the necessary expertise in-house and business networks consolidated on the main pillars: equipment, financing, public authorities and resources. Secondly, waste management companies became increasingly involved in biogas projects, exploiting the landfill gas at the sites they own: 25 of the total 74 projects registered at the end of 2001 in the Idae database for the special regime were using biogas.

The picture of partnership actors has been enriched starting with 1998/9 by the involvement of financial actors: banks and capital venture funds. Investments of financing agents are focused on commercial plants with mature technologies - mainly biomass combustion - and secondary biomass resources, with low cost and availability risks. Their presence has been so far, by 2003, modest in terms of number of projects but significant in terms of the positive signals launched to other potential developers and financing agents that the market for biomass would be soon getting momentus.

Since 1996, industrial production and food companies generating organic wastes move away from self-generation and start investing in commercial projects[18]. But the projects of this group of developers have also two main strategic components - the advantage of zero fuel costs, and financially attractive way of eliminating wastes. However, in the future the role of industrial production companies in the picture of project developers is likely to shrink, because the potential for industrial organic wastes will be exhausted. In contrast, the role of crop and farming cooperatives is likely to increase fast and substantially, as resources are large and at hand. Social reasons related to employment are considered an important driver of farming cooperations to become involved in biomass-for-energy projects. Based on these considerations Table 2 summarizes the situation regarding the motivational factors (own goals) for the various types of actors involved in biomass electricity generation.

Empirical findings indicate that, overall, since 1999 the number of commercially motivated projects increased. There was actually no new self-generation capacity installed between 1995 and 2000. There were 112 MW functioning for self-generation purposes in 1995, while in 2000 this lowered to around 100 MW.

Table 2. The main types of actors and motivational factors to invest after 1995

Main types of actors in PPPs	Main own goals to invest
public actors	confidence building; demonstration; social reasons – employment; commercial interests
energy utilities	commercial; technology / resource demonstration; first mover advantages by means of process-wise information and lower production costs; raising local social interest for biomass resource reliance
Industrial engineering groups	
financial agents	commercial
industrial production & food companies; waste management firms	commercial; strategic – environmentally friendly low/no cost way of waste elimination; social reasons – employment;

As regards the dynamics in terms of types of financing of partnerships, empirical data indicate that in the period before the adoption of the 2818/1998 Royal Decree, projects were overwhelmingly financed based on internal financing schemes, especially in-house corporate finance, debt-corporate finance and multi-contribution finance. Project finance was used only in some isolated cases in this period, but after 1998 it has started to be more frequently used. Banks have been conditioning however their loans on the participation of a large company

[18] Most projects are co-financed by Idae under the third party finance formula.

known to them, usually an energy utility, a public agency/company or the governmental agency IDAE (Fernando 2002). Besides, when the biomass resource supplier is (co)owner, banks are also willing to give project finance[19]. For 14 plants, project finance loans were given based on an agreement between IDAE and Official Credit Institute for governmentally subsidized soft-loans. In total 35 project were based on project finance loans, of the total 73 projects registered in IDAE database of benefiting of governmental price support per kWh.

The increase in the use of project finance at industry level for biomass was facilitated by the governmental agency IDAE (as in the case of wind projects), who adopted a strategy to provide equity in the capital structure of several projects. This increased the confidence of financiers in the commercial feasibility of biomass electricity technologies. Third-party financing of biomass electricity projects has been used, by 2003, only in two cases - one by IDAE (IDAE 2000) and one by a renewables' utility subsidiary, Sinae (2001). The destination of electricity in both cases is mainly for self-generation, selling the surplus to the grid. For both plants, the would-be owners are industrial production companies. The agency IDAE plans to use this scheme more often in the future to encourage more investments. Consequently, public-private partnerships with the involvement of IDAE and/or a public agency/company has facilitated also in the case of biomass electricity – as in the case of wind technology, the transition from internal financing schemes to project finance schemes, which implies a high potential for technology diffusion.

It may be concluded that the PPPs for biomass electricity projects emerged in 1998 in Spain. The main drivers were:

1. Resource complementarity: pooling together the internally available financial resources. Biomass technologies have large economies of scale, which means that the investment costs per unit of MW start to decrease only as the installed capacity of the power plant increases – generally above 50 MW. This means that biomass technology is much more cash intensive that other renewables (except solar PV so far). The presence of public actors was also aimed at convincing financing agents to approve project finance loans
2. Motivational factors (own goals), as summarized in Table 2 per type of actor.
3. Information: this regarded on the one hand 'content-wise information', by in contrast to wind technology it does not refer to the fact that the technology was in course of shaping (the R&D aspect) but to the fact that biomass technologies are technically complex and required constant involvement and operation by energy technology experts. This implies that the presence in the partnership of energy companies of industrial technology corporations is essential. In addition process-wise information was also important as many of the actors were nether previously using biomass resources in previous activities, or energy technologies, or both, and they needed to learn to develop and operate the plant from the standpoint of administrative and business processes.

There are some differences in the goals of actors and their reasons to become involved. E.g the goal of making Spain an internationally strong biomass technology manufacturer does not appear as a driver of IDAE involvement. Most public agents are interested in the very job intensive nature of biomass projects.

The resource aspects appear very strong drivers for partnerships: large economies of scale and hence very high investment costs, biomass resource (while wind is readily and freely available).

[19] But in many cases the debt maturity is lower than in the case of wind projects, only 7-8 years, since banks consider biomass projects more risky and want to recover their loans faster (del Pozo 2001). Also the loan contribution is smaller than in 'normal' projects, in some cases being as low as 40% or 25%.

It could be estimated that the capacity installed and approved between 1996-2001 was slightly above 433 MW[20] (no matter if they were mainly for commercial or self-generation or strategic purposes). But at the end of 2001 there were only 90 MW producing biomass electricity, while around 343 MW were not operating yet.

The governmental target is to reach 1708 MW of biomass power by 2010. The rate of market growth and the achievement of the target will depend on the extent to which there is sufficient biomass resource potential that allows profitable projects under the available price support. The government promised investors in the 1998 renewable policy plan a series of financial support mechanisms for biomass electricity. But by 2001 the government failed to implement the policies announced. The diffusion patterns observed since 1999 suggest that the market - both a large diversity of economic actors and financing agents - is ready to implement substantial investment plans, provided that the economics of biomass power plants allow them to book the required profitability for projects.

4. Discussion - from public-private to new private-private partnerships

In this paper we conceptualized the implementation process of sustainability policies as consisting of a set of policy-making activities and a set of policy operationalisation activities. Both types of activities may include (self-selection of) the same set of actors. The policy-making aspects of implementation have been seen as (most likely, but not necessarily) taking place in a network framework, while policy operationalization may often involve public-private partnerships emerging from that network, and at a later time new private-private partnerships (see Figure 3).

In the empirical sections 4.2 and 4.3 we discussed how actor structures emerged and changed in the PPPs formed for the operationalization of policies aimed at the diffusion of wind and biomass electricity technologies. Figure 4 represents these dynamics in a time dimension, differentiating between three stages: early implementation, transition in PPPs actor structure, and new business relations. Although new (individual) economic actors have continuously joined the partnerships for investments in wind and biomass projects, one can easily note that:

- *in terms of actor categories across PPPs there is an element of constancy*, that is generally (or at least) in the first two phases of the diffusion process) the same types of actors are involved: public authorities, project developers - coming from a wide variety of industrial-economic backgrounds (targets), investors (bringing in first additional and later the main bulk of financial resources), and other actors such as manufacturers of technology, biomass resource suppliers, research centers etc;
- *in terms of actor prominence within individual PPPs there is an element of change*, that is in each of the three phases represented in Figure 4, different actor-categories take different degrees of financial involvement in the projects realized:
    - ~ during the early-implementation stage, the public authorities and/or the economic actors closest to the field of renewable technologies in terms of industrial focus/background (electricity companies; manufacturers of technology) have the most substantial financial contribution to projects; they are in the 'front-line' of partnership formation;
    - ~ during the transition phase, public authorities move to the background while specialized financing agents come to the fore in partnerships; public authorities substantially diminish their financial contribution, while banks and/or specialized

[20] This number was calculated as 473 MW (commercial projects installed or approved by 2001) minus 40 MW (commercial capacity already operating in 1995) = 433 MW; to this one can add the very small new self-generation capacity (which is however not known exactly).

investors contribute to investments either by means of equity or by enabling project finance loans;
~ during the later phase, new business relations are formed that no longer need the presence of public authorities to hold-together a partnership; this signals the shift towards new green private-private partnerships with sustained investment interest in a green electricity industry.

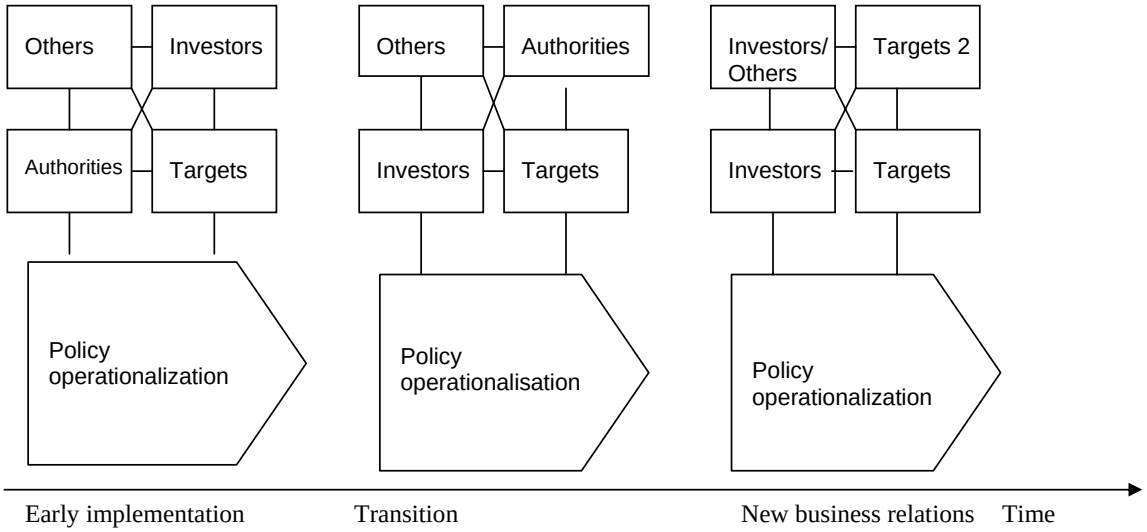

Figure 4. The dynamics of partnerships during policy operationalization.

The actor structures corresponding to the first two phases in Figure 4 correspond typically to project-vehicle partnerships, while the actor structure corresponding to the 'new business relation phase' is typical for wind/biomass-specialized partnerships and renewables-specialized partnerships.

Drawing on the logic of the Contextual Interaction Theory developed by Bressers, the theoretical approach proposed in this paper was to analyze the emergence and dynamics of public-private partnerships by taking actor characteristics as point of departure. We argued that policy operationalization by means of PPPs can be best understood by looking at the motivations (own goals) of actors, the information-related drivers, and the resource-related drivers. Public-private partnerships may help overcome the reluctance/hesitance that some economic actors may have in implementing policies. They can help initiate the spin-offs necessary to make the resource base of electricity industries more sustainable. For this to happen, information and communication plays a crucial role, by identifying each others' own goals and interests, and finding strategies that can help both categories of actors to still achieve their own goals while contributing in the same time to policy implementation. But also the availability of resources is crucial for transforming investment plants into operational renewable energy projects. In Figures 5 and 6 we represented the dynamics in the types of PPPs observed during the policy operationalisation phase for the diffusion of wind technology and biomass electricity technologies in Spain. In the same time, we linked in these figures the types of PPPs with the configuration and motivation-information-resources that have been empirically found as underlying their emergence.

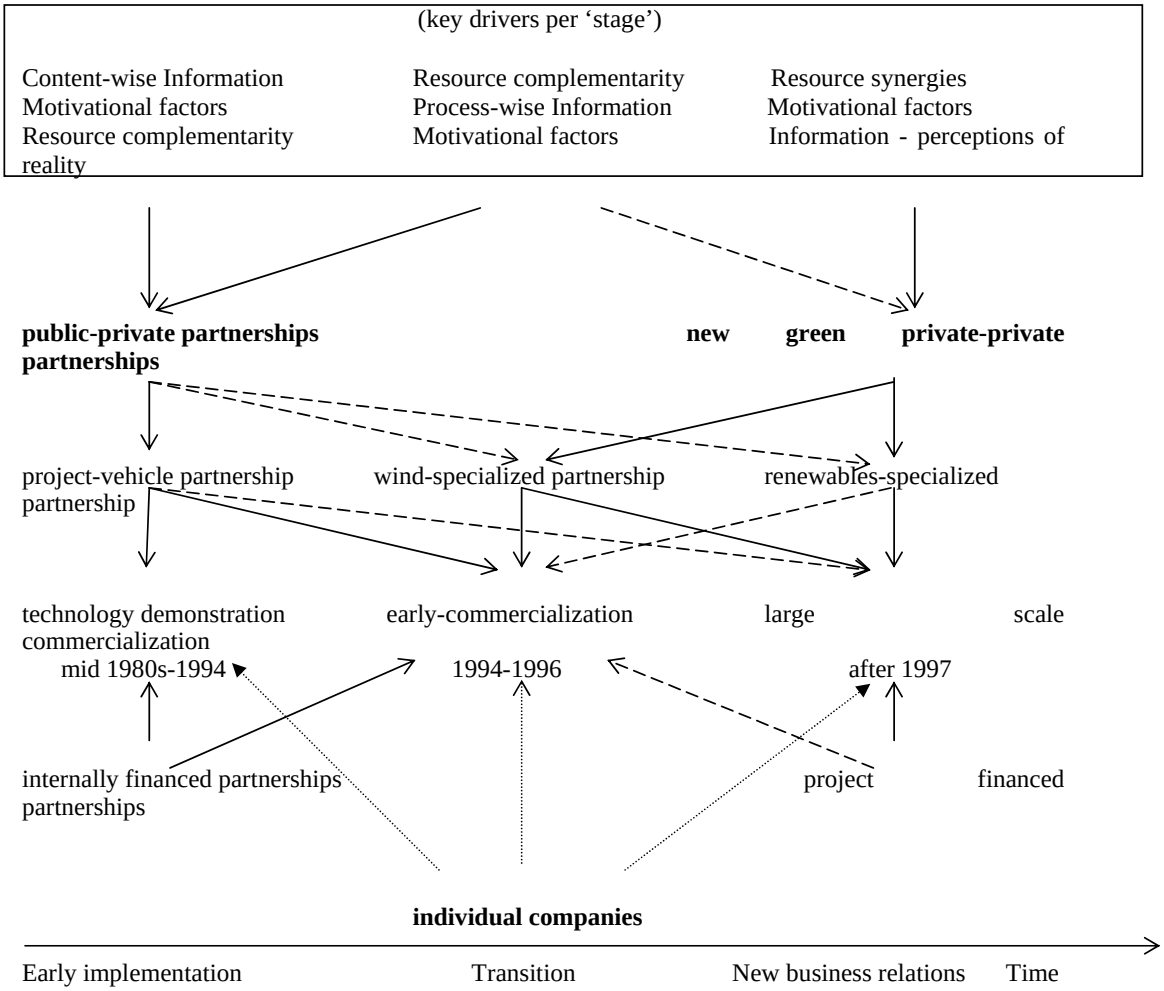

Figure 5. The dynamics of partnerships and drivers for their formation for wind technology.

The situation regarding investments in wind technology and the dynamics of partnerships can summarized as follows.

In the early implementation phase (mid 1980s-1994):

- wind energy projects were overwhelmingly developed by public-private partnerships, while a small number of projects were initiated by individual companies as sole owners (dotted arrow in Figure 5);
- the public-private partnerships were focused on technology demonstration, based on internal financial resources of project developers, who organized their investments in the form of project-vehicle partnerships;
- the key drivers in partnerships' formation were formed – in the order of their importance – by content-wise information needs; own goals of project developers, and the need for pooling resources together to complement each other's capabilities.

In the transition phase (1994-1996):

- wind energy projects continued to be overwhelmingly developed by public-private partnerships, while a small number of projects were initiated by individual companies as sole owners (dotted arrow in Figure 5);
- the public-private partnerships were focused on the early commercialization of wind technology;
- investments took place predominantly by means of internally-financed partnerships (continuous arrow, Figure 5) and to a smaller extent by means of emerging project-financed partnerships (dashed arrow, Figure 5);
- the majority of projects was developed either by project-vehicle partnerships or by joint-ventures that can be described as wind-specialized partnerships, since they already own several wind energy projects and have long term investment plants in wind energy (both represented with continuous arrow in Figure 5); to a smaller extent projects developed during this period were owned by joint ventures that have already become 'renewables-specialized partnerships dashed arrow, Figure 5;
- the key drivers in partnerships' formation were formed – in the order of their importance – by resource-complementarity advantages, needs for process-wise information related to the development and operation of wind projects; and specific own goals of project developers; hence a shift can be observed in the hierarchy of drivers behind partnership formation.

In the phase of 'new business relations' (that started in 1997):

- wind energy projects continued to be overwhelmingly developed by public-private partnerships, while a still small number of projects were initiated by individual companies as sole owners (dotted arrow in Figure 5);
- the public-private partnerships were focused on the large-scale commercialization of wind energy;
- investments took place predominantly by means of project-financed partnerships, which substantially kicked-off the market growth process;
- the majority of projects was developed either by wind-specialized partnerships or by the increasing number of renewables-specialized partnerships (continuous arrows in Figure 5); to a smaller extent projects developed during this period were also owned by joint ventures organized as project-vehicle partnerships;
- this period witnessed the appearance of the first new private-private partnerships, that is joint ventures were no public authorities or public (development) companies were involved as co-owners; some of these new joint ventures are focused exclusively on wind energy investments (wind specialized companies) while others invest in other renewable energy technologies as well (renewables-specialized partnerships)
- the new private-private partnerships are predominantly driven by a set of key drivers represented - in the order of their importance – by: the added value of resources synergy, various types of own goals individual participants hold, and perceptions of reality, especially with regard to the governmental policy for renewables support and its long term reliability, as well as the perceived role of renewable resources in future economic development and environmental policy nation-wise and globally;
- in the same time, a number of new private-private partnerships as well as most of the public-private partnerships appear to be driven by the same key drivers as described above for the transition phase when projects were focused on the early commercialization of wind technology.

Consequently, the dynamics in the types of partnerships for wind technology have been accompanied by clear dynamics in the hierarchy of the key drivers behind partnership

formation. But the key drivers remain within one of the three categories of core actor and partnership characteristics identified in the theoretical part of the paper.

The situation regarding investments in biomass technology and the dynamics of partnerships can summarized as follows.

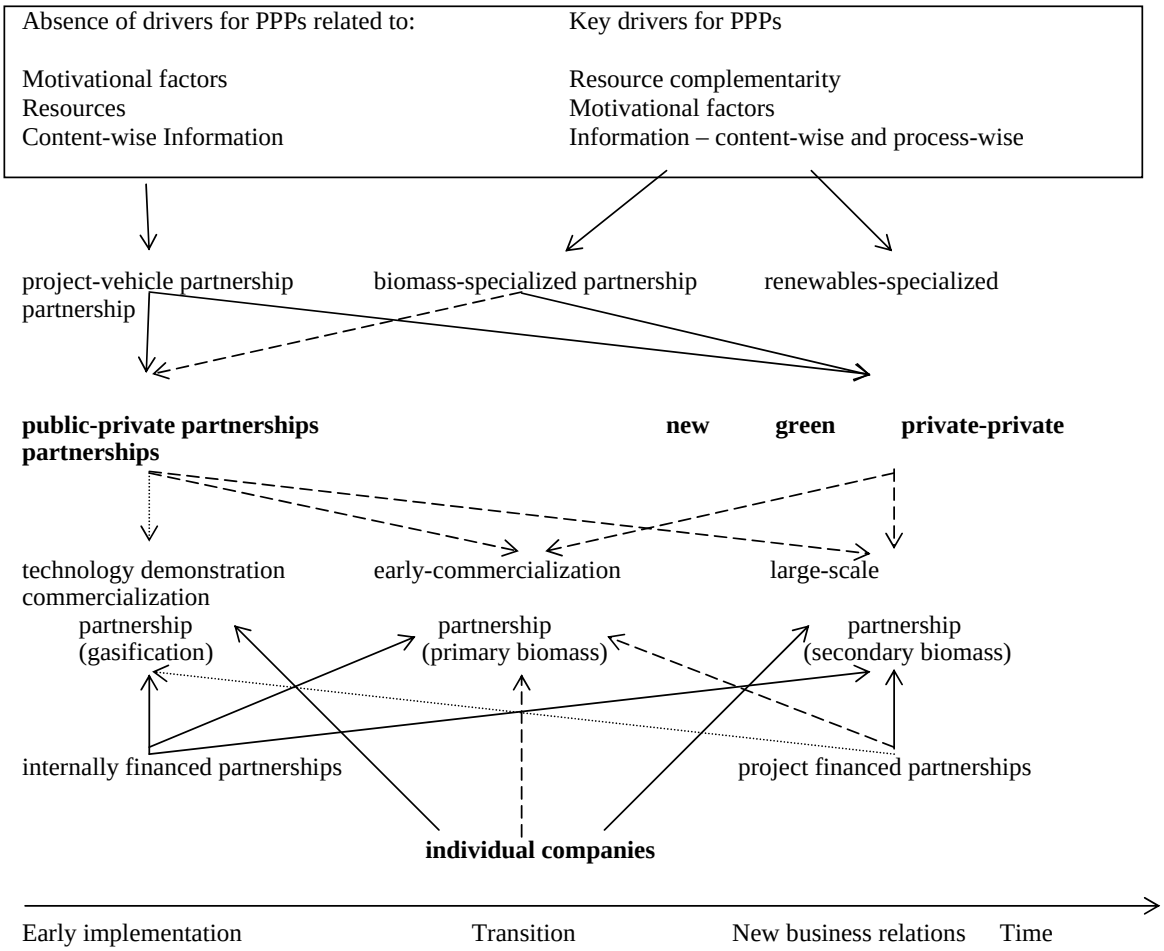

Figure 6. The dynamics of partnerships and drivers for their formation for biomass technologies in Spain.

In the early implementation phase mid 1980s-1995:

- biomass projects were only developed by individual companies as sole owners up to 1995;
- the public-private partnerships were only to a very small extent involved in technology- demonstration for gasification-based plants (dotted arrow in Figure 5); these were organized in the form of internally-financed, project-vehicle partnerships (continuous arrows on the left side of Figure 6); very few investments were based in project-financed partnerships (dotted arrow, Figure 6);

- the main reasons for the absence of partnerships - in the order of their importance – are:
  ~ motivational a) governmental price support was insufficient and did not support the commercial interest of economic actors; content-wise information needs; b) the priority of the government laid on another renewable technology;
  ~ resources: the biomass resource market was not organized
  ~ information: the perception that substantial technology development still needed.

In the transition phase (1996-1997):

- early commercialization partnerships for projects using primary biomass emerged;
- they were developed by three types of investors: individual companies, public-private partnerships and new green private-private (dashed arrows in Figure 6);
- most of these investments were internally-financed partnerships (continuous arrow) while to a smaller extent project-finance partnerships were also observed (dashed arrow);
- the public-private partnerships were mainly project-vehicle partnerships and to a smaller extent they were biomass-specialized partnerships.
- the key drivers in partnerships' formation were formed – in the order of their importance – by resource-complementarity advantages, specific own goals of project developers (see Table 2), and needs for both content-wise information and process-wise information related to the development and operation of projects.

In the phase of 'new business relations' (that started in 1998):

- the large-scale commercialization of secondary-biomass-based technology has been mainly taken place by means of individual companies as sole owners (continuous arrow in Figure 6); but to smaller degrees, PPPs and new private-private partnerships have also been playing a role in the diffusion of such projects;
- new private-private partnerships have been observed in the form of both project-vehicle partnerships and biomass-specialized partnerships;
- investments have been equally based on internal financing schemes and project financed schemes;
- the same hierarchy of the key drivers in partnerships' formation were observed also for the phase of new business relation, which is in its very early stage in the case of biomass technologies.

Consequently, as regards biomass electricity technologies, Spain is not yet in the stage when (biomass)-specialized partnerships dominate. Investments are still focused on the early commercialization of technology by means of project-vehicle partnerships. Besides, a higher number of individual companies develop projects as sole owners, as compared to the case of wind technology. There are three main reasons for this:

1. the level of financial governmental support is not sufficient to convince actors to join forces for biomass-specialized partnerships;
2. the market for biomass resources is missing; there is need for a substantial governmental support to prepare the market for the so various types of biomass resources;
3. the technology is diverse and the designs that are more technically and economically efficient are new (gasification and pyrolysis); many potential partners consider that there is still a need for technology learning before committing themselves to biomass technology.

Thus, a shift to sustainable development is likely to experience more generations of partnerships. These will have: (slightly) different actor-composition and different core drivers:

- political goals, strategic drivers, information related drivers, and resource-interdependency are likely to dominate the first generation of partnerships;
- commercial reasons and resource related drivers are likely to dominate the second generation of partnerships (which is just fine because the goal is to “green the business”).

5. Conclusion

The central argument in this paper has been that public-private partnerships are organizational entities helping the transition towards sustainable development but which are themselves in a process of transition, with changes in the types of activity, types of investment and types of financing for the technologies on which they focus. Empirically, the paper analyzed the greening of electricity industry in Spain and looked specifically at the cases of wind electricity and biomass technologies’ diffusion. The evolution of PPPs shows clearly that there is a transition from ‘project-vehicle-partnerships’ to ‘technology-specific-partnerships’ to ‘renewables-development partnerships’. In parallel there is a transition from ‘internally-financed-partnerships’ towards ‘bank-financed-partnerships’ with a substantially higher diffusion potential. Finally, another transition was observed from ‘learning-partnerships’ towards ‘commercialization-partnerships’. As the greening of the electricity industry advances, there is a gradual retreat of public actors and an increase in new green private-private-partnerships. Understanding the metamorphosis of partnerships supports policy-makers to design policies facilitating wider engagement in PPPs, a more secure operation environment and a faster transition towards new green private-private partnerships in industrial activities.

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Manuel Bustos, Public Relations, Communications Department, Association of Renewable Energy Producers (APPA)
Lopez, Cristobal Lopez – wind power engineer, Iberdrola Ingineria y Consultoria (subsidiary of the second largest electricity company)
Castillo, Joaquin, Union Fenosa Energias Especiales (UFEE – subsidiary of the third largest electricity company)
Carrasco, Juan – Biomass Department, Center for Energy, Technology and Environmental Research (CIEMAT)
Utrillas Saez, Antonio – Technical Director, DeWind Iberia company
Arrieta, Jose – Director, Energia Hidraulica Navarra company
Rojas Barcona, Alberto de – Industrial Engineer Energy and Environment, Elecnor Technology and Products company
Fernandez Borbons, Marta – Director Renewable Energy, SINAE company
Fernandez Jesus – Scientific President, The Spanish Biomes Association (ADABE)
Lara Cruz, Antonio de – General Director, MADE Tecnologias Grupo Endesa (wind technology manufacture company long time subsidiary of the largest electricity company)