Recovery after the disappointment: a policy perspective

Margarida Fontes
LNEG – National Laboratory of Energy and Geology, Lisboa, Portugal
DINÂMIA'CET, ISCTE-IUL, Lisboa, Portugal

Nuno Bento
DINÂMIA'CET, ISCTE-IUL, Lisboa, Portugal
Universidade Católica Portuguesa, Departamento de Economia, Gestão e Ciências Sociais de Viseu, Portugal

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Abstract

This paper aims to understand the factors that permit to restore policy support in the recovery of emerging socio-technical systems, after a cycle of hype and disappointment. The approach combines contributions from the sociology of expectations, innovation policy studies and socio-technical transitions literature to discuss the processes that enable system actors to regain policy support; and how these processes can also induce system recovery. The review of the literature suggests a number of elements - at the system level, at the policy level and at their interaction - that are key in the process of recovery. This framework is applied to study the marine renewable energy technologies system in Portugal, which offers an exemplary case of hype followed by disappointment that entailed the nearly complete withdrawal of policy support. The analysis reveals the strategies and practices used by system actors to reframe expectations in order to attract policy makers' attention, and to ensure that they are incorporated in the policy agendas. It also reveals the motives behind policy makers' disappointment and shows how their behavior influences the recovery work of system actors. Finally the analysis reveals how the interplay between system and policy levels impacts on system recovery. The findings shade new light on the influence of policy on recovery after hype and disappointment.

1 Introduction

This paper addresses the influence of policy in system recovery, after a cycle of hype and disappointment. The processes that lead to hype and disappointment and their impacts on the trajectory of emerging technologies have been studied by several authors, both in the sociology of expectations and in socio-technical transition literatures (Van Lente et al., 2013; Bakker et al, 2012; Geels and Raven, 2007). This research pointed out that emerging technologies need temporary protection against the selection pressures of the established regimes, and that public policies are a particularly important form of protection (Kempt et al, 1998; Smith and Raven, 2012; Kivimaa and Kern, 2016). But because these technologies are still characterised by high uncertainty, support is based on expectations, i.e. promises of future performance and visions of future economic and social benefits (van Lente, 1993; Borup et al, 2006). Expectations can be "performative", that is, when they are widely shared they create requirements that need to be fulfilled (Van Lente, 1993). Disappointment occurs when the performance of the technology falls short of the sometimes inflated expectations created around it.

Research that investigated the conditions that lead to recovery after disappointment found that policies tended to be relatively unaffected and concluded that continuity of policy support was a critical factor in such recovery (Markard and Ruef, 2010; Van Lente et al, 2013; Melton et al, 2016). But, such continuity may not always occur. Policy makers can also be affected disappointment and that behaviour may result on a reduction or even withdrawal of policy support. This can be particularly damaging for an emerging socio-technical system, since it simultaneously reduces the amount of resources directly provided and the legitimacy towards other actors offered by policy endorsement of the technology (Kivimaa and Kern, 2016; Konrad et al, 2012). However, both the implications of disappointment at policy level and the conditions for recovery of policy support are not well understood. This is a significant gap, since it is our contention that when policy support is lost, its restoration is a critical step to recovery. Thus the goal of this paper is to understand how policy support can be regained and how this process can equally induce overall system recovery.

The paper combines contributions from the literature on expectations and from innovation policy studies to investigate the processes that take place in the downturn period, considering both the socio-technical system side and the policy side, and putting the emphasis on the agency of actors. In the policy side, the paper examines the motives behind disappointment among policy actors, and how their behaviour - and more generally the conditions of the political process - influences and is influenced by the recovery work conducted by system actors. In the socio-technical system side, the paper investigates the activities conducted by core system actors as they attempt to rebuild expectations and engage in new development paths, as well as the conditions that influence (positively or negatively) their efforts. Particular attention is given to the opportunities that may arise for system actors to attracting attention of policy makers to the reconfigured expectations, and to the strategies they deploy so that these expectations are ultimately adopted by policy actors and incorporated in their policy agendas. Finally the paper investigates how the dynamic nature of the process of expectation formulation, voicing and sharing, and the emergent and interactive nature of innovation policy making combine, over time, to give rise to a wider dynamics, along which the efforts to restoring policy support induce a process of system recovery.

Empirical analysis is conducted in a case where the disappointment after a period of hype was associated with an effective reduction of policy support – the case of marine renewable energies in Portugal. Previous research on that empirical context has shown that disappointment resulting from unfulfilled expectations about technology performance led a

substantial part of the "non-core" actors to abandon innovation activities and/or to disengage from other forms of involvement, and that this disengagement also included the government. It has also shown that the impact of this abandon was considerably aggravated by the effects of an external shock – the financial crisis - that hit the country strongly, having had a profound impact upon economic activities in general and leading to major political changes (Fontes et al, 2016; Fontes et al, 2017). Thus this is a case where government policies did not act in counter-cycle and where, given the extent of the downturn, core system actors had a strong incentive to recover policy protection, both for obtaining resources and for legitimacy purposes. Recent developments point to recovery of policy support and also to a slight increase in activity and thus it is relevant to understand how this was achieved.

The final objective is to identify factors that enable recovery after disappointment when disappointment also affects policy actors, with negative impacts on policy support, which has to be restored if recovery is to be achieved. By bringing contributions from the literature on expectations and from innovation policy studies into the framework of sustainability transitions analysis, we are able to investigate in greater detail a still not well understood step in the non-linear trajectory of emerging technologies – the process of recovery after a downturn.

2. Conceptual framework

2.1 Factors that lead to expectations recovery after hype and disappointment

The transition to a sustainable energy system is a major societal challenge requiring profound transformations in existing socio-technical systems (Markard et al, 2012). These processes have been addressed by the sociotechnical transitions literature that called the attention to the role played by radically new technologies, which have strong transformative potential (Kemp et al, 1998; Schot and Geels, 2007). These technologies and the socio-technical systems developing around them often need temporary protection against the selection pressures of the established regimes (Geels, 2002; Smith and Raven, 2016); and supportive policies are a fundamental mode of protection (Kivimaa and Kern, 2016).

Policy support not only provides resources but also offers legitimacy, contributing to attract other actors. This is important since ability to engage external actors, to expand networks and build a constituency around the technology is critical to access the resources and competences necessary to develop the technology and to articulate it (align it) with societal needs and institutional structures. In the case of new renewable energy technologies government support can be particularly important given the complexity of the system and magnitude of the changes that may need to take place. Government policies are further justified by the need to accelerate the transition process, given the urgency of fighting against climate change.

In the case of emerging technologies the motivation to support is not based on actual (market) performance but rather expectations regarding future performance and benefits. Thus, expectations play a central role in the development of new technologies. In the early years, technologies feature a high level of uncertainties (e.g. over technologies, costs, performances, markets, regulation, infrastructure) (Kemp et al, 1998; Bergek et al, 2008; Konrad et al, 2012; Bento and Wilson, 2016). In this context, actors take decisions based on prospects, rather than objective information. The theories of "sociology of expectations" in science and technology call these prospects collective expectations, i.e. beliefs or anticipations that drive decisions and are shared by a broad range of stakeholders (van Lente, 1993; van Lente and Rip, 1998; Borup et al., 2006; Bakker et al, 2011, 2012). The optimistic prospects make possible the investment

in the development of uncertain technologies at the risk of creating a hype that is followed by a general disillusion or disappointment.

The hype and disappointment cycle is a phenomenon well documented in the literature (see, e.g., Van Lente et al., 2013; Bakker et al, 2012). A popular representation of this non-linear expectation dynamics is the empirically observed "Gartner hype cycle" (Fig.1). This stylized fact has been proposed by two Gartner consultants to define the optimal timing of investment in emerging innovations (Fenn and Time, 2007). The basic regularity starts with a technological trigger that raises public attention and culminates in a peak of inflated expectations or "hype." At this point the technology fails to meet the promises in terms of costs/performances or market ambitions (Bakker et al, 2011, 2012; Ruef and Markard, 2010), and thus the peak precedes a strong disappointment and decline of expectations that leads to the trough of disillusionment. The technology eventually recovers and gradually enters into a slope of enlightenment (i.e. a less visible period of slower, but surer, progresses), preparing it to reach the plateau of productivity that enables commercialization.

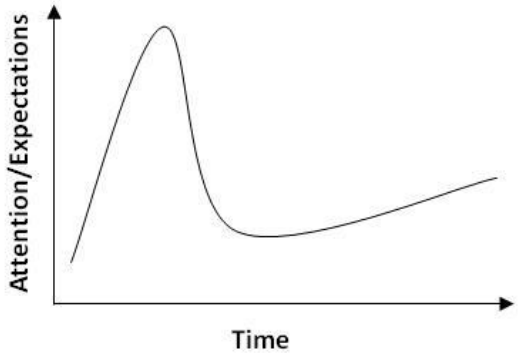

Fig.1 The Hype-disappointment cycle

Governments have been described as participating in and contributing to hype and disappointment cycles through policy and funding, namely by making high-level political announcements or setting overly optimistic targets (Melton et al, 2016). Brown, N. & Beynon-Jones (2012) point of some persistent policy-making features in what concerns promises made by technology advocates: uncritical susceptibility to promissory scientific claims by technology promoters; a policy need to react rapidly to often unchallenged claims about imminent benefit; a tendency to set measures that are not adequate to support long-term processes; an "institutionalised historical amnesia" leading to inability to reflect on previous experiences of hype and disappointment. All these features suggest that, like other actors involved in these processes, policy makers are also susceptible of disappointment (Bakker and Budde, 2012). Given the critical role of policy support for system development, policy disappointment can be highly detrimental to the emerging system, inhibiting or delaying recovery.

The literature has uncovered a number of conditions that contribute to mitigate the extent of disappointment and facilitate recovery of expectations (e.g. Ruef and Markard, 2010; Konrad et al, 2012; Van Lente, 2013; Kirkels, 2010; Kriechbaum et al, 2018). The next sections analyse these conditions.

2.1.1 Conditions that contribute to recovery after disapointment

Research that addressed this question has uncovered a number of conditions that may contribute to mitigate the extent of disappointment and facilitate recovery. It has also

provided insights into actions conducted by technology advocates to cope with the effects of disappointment and induce recovery.

The conditions identified by the different authors can be organised in 5 main types of factors

- Factors related with the level of expectations that was affected by disappointment
- Factors related with the degree institutionalisation the system had previously achieved
- Factors related with policy support
- Factors related to the nature of (constellations of) actors in the system
- Factors related with agency of actors

Level of expectations affected

Factors related with the level of expectations that was affected by the disappointment have been addressed by some authors, who draw on Van Lente's (1993) distinction between a micro, meso and macro level of expectations to discuss whether the level(s) affected, and in particular their combination or alignment (Ruef & Markard, 2010; Van Lente et, 2013; Kriechbaum et al, 2018) influence the outcome after disappointment. Ruef and Markard (2010) defined three types of expectations - specific to a product or project (micro); generalised expectations about the future of the technological field (meso) and frames, i.e. expectations regarding the role of the technology in society (macro) – and argued that these types expectations can evolve differently. They gave particular attention to frames and generalised expectations and proposed that particular combinations between these levels would have diverse impacts on field activity and even on its continuity. This is because generalised expectations have impacts upon the guidance of innovation activities, while impact upon the legitimacy of the field. Thus if both frames and generalised expectations are affected, the prospects of the field are the lowest; while when only generalised expectations are affected the legitimacy is intact and actors have better conditions to rethink direction and adjust expectations accordingly; and when only frames are affected, positive results may enable actors to pursue the innovative activities while attempting to fit to a different frame. The advantages of a misalignment between expectation levels was equally defended by Van Lente et al (2013) who also concluded that the three types of expectations may develop differently over time and compensate for one another.

The level of expectations that is affected may also be relevant when actors are attempting to recover policy support. In fact it has been found that policy actors tend to attribute greater importance to expectations that are related with the association between the technology and broader societal challenges (Budde et al, 2012), which means that they may be more sensitive to disappointment at frame level. One possible explanation is that policy makers are required to offer solutions to address these types of challenges and thus hardly pressed to deliver solutions (Verbong et al, 2008). This is confirmed by other research that discussed how a technology's capacity and opportunity to emerge as a credible solution to a major societal problem influenced policy decisions towards its support (Normann, 2015). Thus political support is likely to be very much contingent on policy makers perceptions of a match between the promises made by technology advocates and their political goals.

Degree of institutionalisation achieved by the system

The degree of institutionalisation of activities that was achieved during the hype is regarded by several authors as critical, both to enable some continuity of innovation activities and to sustain actors efforts towards the reconfiguration of expectations (Ruef & Markard, 2010; Kirkels, 2010; Van Lente et al, 2013; Bakker and Budde, 2012; Temmes et al, 2013). This

generic label refers to the extent to which high expectations not only permitted to mobilise new actors and resources, but were also translated into concrete actions and resulted in the formation of relatively stable institutional structures at both field and organisational level.

Institutionalisation processes at field level include the creation of field level collective organisations and the emergence of a variety of networks (Ruef & Markard, 2010; Musiolik and Markard, 2011). They also include the setting-up of long term public research programmes. Institutionalisation can also take place at organisation level, as when a long term strategic commitment is made, namely involving the setting-up of technology-specific internal structures that provide stable conditions for in-house or joint activities (Bakker and Budde, 2012)

The effective translation of expectations into sustained activities that outlast the hype can also be also related with what Bakker & Budde (2012) define as the presence of "genuine" expectations, i.e. expectations that are backed by innovation efforts and investments along the paths proposed. When this does not happens and a substantial part of the actors does not convert discourse into action, the post-hype recovery is likely to be harder.

Empirical studies in which these conditions were found to exist, found evidence of some continuity of innovation activities, even if at a more reduced scale, while actor abandon of the field was low. However, Ruef and Markard (2010) point out that this behaviour may likely to result from a combination between a certain degree of institutionalisation and the continued legitimacy of the technology, since frames appeared to remain intact.

Continuity of policy support

As referred above, institutionalisation at policy level was an important element of stability, enabling the continuity of innovation activities. This institutionalisation could assume the form of long term funding programmes and, eventually, dedicated organisations (e.g. government or public/private agencies) to manage them, in order to providing policy stability. This approach has been frequently adopted by the European Union with supra-national programmes and organisations often driving or even compensating for country level policies (Kirkels, 2016).

More generally, continuity of policy support, or even its reinforcement to compensate for the abandon of private investors, was referred by several authors as one key factor to mitigate disappointment (Ruef and Markard, 2010; Kirkels, 2016; van Lente et al, 2013). Policy funding was particularly pertinent to core technology developers, which were more vulnerable to fall in expectations and associated decline in external support (Konrad et al, 2012; Bakker and Budde, 2012).

But more than simple mitigation, government intervention at this stage could be a deliberate strategy to counteract the downturn, or to drive a proper re-assessment of the technology situation and future possibilities, in order to reformulate expectations that are more adjusted with reality.

Interestingly, most empirical research has found that policy support (at country and/or at supra-national level) was maintained, suggesting that policy makers were not negatively influenced by the decline in expectations and acted at counter-cycle. The fact that in most of this research it is implicit or explicit that "frames" or "macro level expectations" were not affected, that is, that broader goals remained relevant, can contribute to such sustained

support. But this is not necessarily the case and in a few cases there is evidence that such support was considerably reduced (Fontes et al, 2016; Belot & Picard, 2014).

Type of actors and their reaction do disappointment

According to Konrad et al (2012) different types of actors have diverse levels of sensitivity towards changing expectations. When core field actors, which play an essential role in the system, are highly sensitive, the impact is likely to be greater and thus the constellation of actors that compose the field is a relevant factor. High sensitivity can be found among actors that are more dependent on others for their activities and thus are more sensitive to external legitimacy (e.g. technology developers or research organisations with limited base funding); while lower sensitivity can be found among actors that have weak strategic embedding of the new technology. Konrad al (2012) also looked at the way different types of actors react to disappointment and found research organisations tended to reacted more slowly than industry actors. Konrad and Alvial-Palavicino (2017) further addressed the dynamics of the process and found hype and thus disappointment may not occur for all actor groups at the same time, following different dynamics in different communities.

Bakker et al (2011) also found differences between how types of actors react to changing expectations and, in particular, that they differ regarding the level of expectations whose fulfilment concern them the most. They found that scientists tend to maintain positive expectations as long as these give them a mandate and funding for pursuing with research; while meeting expectations is more vital for industry, in particular the generalised expectations about the technology. Conversely, for policy actors meeting expectations at the macro level is the most crucial, since they need to make promises about how they will solve societal problems (Budde et al, 2012)

Bakker and Budde (2012) add that the impact of disappointment depends on how tied are actors to the success of a particular technology option. While some actors are clearly dependent on the success of that option (e.g. entrepreneurs) others may be more flexible in that respect, even if they shared expectations about it (e.g. utility that explores a portfolio of clean technologies and thus may be part of multiple technological communities). This has implications for the ability to change the technology trajectory, namely in cases where there was shift of policy attention to a different technology option (Verbong et al, 2008).

This research indicates that the nature of the actors that compose the field – and that remain in it after disappointment - can have an important impact upon the subsequent recovery. It also suggests that technology developers and other dedicated technology actors are likely to be those more affected by reduction of external (private) investment, which makes them more reliant on public support (Bakker and Budde, 2012). Support withdrawal at that level is thus particularly serious to them.

Finally, Van Lente et al (2013) argue that nature of the environment in which the technology is embedded is also relevant. Rich environments, with a variety of research and business activities, that offer a wider variety of opportunities for technology application across different sectors, can provide better conditions to re-orient expectations after disappointment; providing that the technology also has scope for a diversification of applications.

Factors related with actors agency

The ability of system actors to critically rethink activities and to rephrase or modify expectations making them more adjusted to reality has been generally described as critical to recovery (Van Lente et al, 2013; Bakker et al, 2012; Ruef & Markard, 2010; Budde et al, 2012; Konrad et al, 2012; Kirkels, 2016). However, how actors shape recovery is clearly dependent on the conditions available (Van Lente, 2013). Thus, the whole set of aspects described above – level of expectations affected, nature of actors involved and degree of institutionalisation achieved – will condition the type of strategies system actors can deploy (Van Lente et al, 2013; Bakker and Budde, 2012; Konrad, 2012). In particular, the extent of divestment in the field following disappointment is relevant, because activities conducted to renew promises will gain in credibility if backed by innovation activities (Konrad et al, 2012). Similarly the extent of actor abandon - and namely who abandons - is relevant, because the nature of supportive networks and the presence of credible individuals can be critical to provide legitimacy to the new claims (Bakker et al, 2012; Temmes et al, 2016).

While all these conditions are equally relevant in what concerns the efforts targeting policy makers, one further aspect may also be determinant in that case: the extant political conditions, both in terms of politics and political processes (Meadowcroft, 2009). These will both influence the frame (e.g. the broad political goals) against which expectations need to be (re)matched and the receptivity to the expectations work to be conducted.

The type of strategies and activities used by the technology advocates to restore expectations and regain support will be discussed in detail in section 2.3. In the next section we will discuss in greater detail the issue of political conditions and their implications to actors recovery efforts, drawing on innovation policy and transitions policies literatures.

2.2 The policy level: motives for policy withdrawal and opportunities for recovery

The literature generally acknowledges the role played by government policies in the development of expectations and, particularly, in making them "performative" through requirement setting and legitimation (Melton, 2016; Flanagan et al, 2011). It is also recognised that government policies can greatly contribute to hype and disappointment (Brown and Beynon-Jones, 2012). But while the reasons behind government involvement in the emergence of hypes are frequently addressed, there is less interest in the processes behind government disappointment and withdrawal of support. Similarly, while continuity of policy support emerges as critical for recovery, there is still limited investigation on the processes that underlay renewal of policy support after withdrawal.

It is our contention that these two aspects are related and that to understand the conditions to regain policy support it is necessary first of all to understand the motives that led to its withdrawal. So, this section starts by discussing these motives and subsequently addresses the process of policy making and the opportunities it provides to recover policy support.

2.2.1 Motives for withdrawal of policy support: unfulfilled expectations vs. other motives

Unfulfilled expectations

The motives for support withdrawal are relevant because they may influence subsequent policy makers' behaviour. Unfulfilled expectations can be one such motive. Policy makers, as other external actors, may believe in inflated promises – particularly if they fit well to their policy goals – and thus be disappointed if they are frustrated. Indeed, the literature suggests that policy makers can be particularly susceptible to promises made by technology promoters

and accept their claims rather uncritically (Brown and Beynon-Jones, 2012). In the case of policy makers, it is likely that disappointment as providers of resources regarding the performance of the technology is combined with disappointment as politicians regarding the expected contribution of the technology to the policy goals they set, since this may reduce their credibility towards their constituency (or their position relative to other government departments). This effect may lead to what has been described as "bandwagon and circus dynamics" (Verbong et al, 2008), which is typical of fields that become highly politicised and where policy makers need to show success quickly. In these cases policy makers accept eagerly the promises made and "jump in the bandwagon" of the technology, but are also easily disappointed by any set-backs and move quickly to another promising technology, in a process of succession of expectations (Verbong et al, 2008). For the abandoned technology this not only means the risk of losing the resources directly provided through policy mechanisms, but will also result in a loss of credibility towards other investors. It may also raise the threat of the new "promising technology" to emerge as a competitor. But overall, a constant shift of policy of focus signals lack of consistency and can have a negative impact in the whole field (Melton et al, 2016) reducing the confidence of potential investors.

These processes may not just affect the generalised expectations about the technology, but in the limit, lead to a mismatch between the technology and broader policy goals, that is, to a situation where there is alignment between the expectation levels affected by disappointment, a situation that can be particularly detrimental for the technology (Van Lente et al, 2013).

However, the mismatch between technology and policy goals may also happen for other reasons. In fact, policy goals may change for various reasons (Flanagan et al, 2011) and thus, the promises made by the technology may lose its appeal as contributors to these broader goals (Normann, 2015).

Political conditions and policy processes

Policy withdrawal or major change of policy direction may also happen for reasons that are not directly related with the performance of the technology, even if the coincidence between these processes and a phase of technology downturn can make it more serious and thus contribute to aggravate the causes of disappointment.

Innovation policy studies discuss several reasons for this. They point out that innovation policy making is an emergent process that is itself fraught with uncertainty (Flanagan et al, 2011; Flanagan & Uyarra, 2016; Martin, 2016). Thus, there may be unintended consequences of policy intervention that create new situations and drive policy re-orientations (Hoppman et al, 2014). A related effect concerns the difficulties associated with implementation of complex policy-mixes, where interdependences between policies may result in failures to produce the results if the whole mix is not correctly implemented (Martin, 2016; Rogge and Reichardt, 2016). Attention also has been called to the role played by influential actors with vested interests in particular technology trajectories, which may explore negative outcomes to reduce support to potentially competing technologies (Lauber and Jacobsson, 2016; Geels, 2013).

More generally, these authors have argued that innovation policy dynamics interact with other dynamics – e.g. budgetary, political, economic, social – with their own logics and thus the trajectory of specific policies can be affected by the outcomes of these other processes. From the standpoint of the technologies being protected by these specific policies, unexpected events taking place at these other levels can act as "external shocks" (Hoppman et al, 2014). These shocks may have a more or less strong impact on the direction or even the continuity of

policy support. When these shocks not only influence political decision making (e.g. change of government) but also affect the innovation activities performed by technology promoters or the investments made by their private sponsors (e.g. economic crisis), the combined effect of reduction of economic activity with reduction of policy support can be particularly serious. Indeed, the actual fragility of the technology may be a caveat in these circumstances, since policy makers may choose to focus on technologies that can offer more guaranteed chances of supporting economic recovery (Normann, 2015).

Motives for policy support withdrawal can therefore influence the ability to regain it. In particular, abandon when policy disappointment is associated with loss of fit with policy goals may be relatively less complex to address - there is evidence of successful attempts at reframing expectations (ref) - than abandon related with general scarcity of resources and, especially, than the combination of both.

Extent of disappointment

On the other hand, the extent and scope of disappointment and support withdrawal is also an important factor. The policy space is not homogeneous, and policy making takes place different levels. Different governance levels – national, regional, supranational – may react differently and, in the limit may have different policy goals and formulate and implement policies differently (Laranja et al, 2008; Quitozow, 2015; Bulkeley, 2005). Similarly, government areas related with different policy domains may have diverse attitudes and practices (Magro and Wilson, 2013; Matti et al, 2017). Indeed governments have been described as a heterogeneous mix of actors with often competing interests (Normann, 2015). As a result technology promoters may find a greater receptivity to their claims is some policy levels/areas than in others and the extent of disappointment may also differ between them.

The extent of institutionalisation of the policies is also relevant. In fact, if long term policies had been set-up, at least some of them might remain active. In particular, if a mix of policy instruments had been implemented it is possible that, given to the path dependent nature of policy making (Flanagan et al, 2011), some of them will be retained, even if the coherence of the mix may be lost (Rogge and Reichardt, 2016).

Finally, the degree of change in policy goals (and thus in policy direction) is also relevant. Changes that reduce the match of the technology, but still retain a broader approach to societal challenges where the technology can seek to fit (e.g. clean energy production) are not as detrimental as the definition of new strategic goals that are considerably distant from the potential contributions of the technology, or even assert principles that are contrary to it (Ruef and Markard, 2010).

2.2.2. Opportunities to regain policy support

In what concerns the opportunity to regain policy support, recent innovation policy literature argues that policy making is shaped by the interests and efforts of a multiplicity of actors, both from within and from outside de policy space (Flanagan et al, 2011; Flanagan & Uyarra, 2016). These approaches put a strong emphasis on the agency of actors in relation to policy and its outcomes. Agency is expressed not only in relation to the processes through which policy problems are identified and solutions emerge, but also in relation to the ways the outcome of these processes are translated into practice, through policy design and its implementation (Flanagan & Uyarra, 2016). These processes are also seen as dynamic, being influenced by evolving conditions and by actors' responses to them. Thus, it is recognised that there is scope for intervention of system actors in process of policy design and implementation. This equally

recognised in transitions research (Raven et al, 2016). According to some authors policies are actually shaped through negotiation between state and non-state actors (Smith et al, 2005), even if the different actors have diverse opportunities to intervene in and influence such negotiation (Jacobsen and Lauber, 2006). In fact, actors occupy different positions in the system, have different and sometimes conflicting interests and diverse capacities to influence (positively or negatively) the policy processes (Avelino et al, 2016).

Recent streams in innovation policy studies have also stressed that is necessary not just to understand the impact of policies on the evolution of the innovation system, as is traditionally the case, but also to consider how the system feeds-back to the policy making space (e.g. enabling policy learning) and, more generally, to understand the influence of processes taking place at system level on policy design and change (Martin, 2016; Kemp and Pontoglio, 2011; Rogge and Reichardt, 2016). In other words these approaches posit the need recognise the presence of interdependence and co-evolution between policy making and technological change.

We believe that an understating of this co-evolution can be pertinent to address the interplay between system actors and policy makers along hype and disappointment cycles. Although there is still limited research at this level, some authors have started to address the processes taking place and the type of factors that shape them (Hoppman et al, 2014; Reichardt et al, 2016; Matti et al, 2017; Fontes et al, 2017). On the other hand, an important stream of research on transition policies have mobilised contributions from policy theories to go in greater depth into the policy processes that are behind the actual policy making process, that is, to understand how policy design and especially of policy change takes place (Edmonson et al, in press; Kern & Rogge, 2017, Reichardt et al, 2017; Markard et al, 2016).

In this research we are not interested in focusing on how actor influence is turned into policies. We are interested in what actors do to achieve that goal - that is in the "recovery work" conducted by the technology actors. We aim at understanding the nature of activities conducted to re-attract the attention of policy makers and re-engage them with the technology, and assessing whether this brings about (positive) policy decisions and, particularly, at uncovering the dynamics of this process. Following the notion of co-evolution between policy making and technological innovation, we expect this to be an interactive process that takes place over time and that there will be some co-evolution between the dynamics taking place at both levels.

The above discussion that points to the relevance of actors agency in policy making, lead us to consider that is necessary to focus on the behaviour of actors, both technology-related actors and policy makers - and on the results of their interaction. Similarly, the literature on expectations posit that expectations (building and sharing) are a result of human agency (Bakker and Buddde, 2012), implying that actor behaviour will be central in processes of recovery. Thus, it is particularly important to understand the strategies system actors adopt aiming at changes in policy makers' behaviour.

2.3 Actors strategies for recovery: reconfiguring expectations and regaining policy support

2.3.1 Actors' repair work

The strategic niche management literature offers some important insights into the actions of system actors when technology performance is below expectations (Geels and Raven, 2006). These authors are concerned with explaining the changes in direction of the niche trajectory, which they propose to be related to a change in the contents of expectations that result from

actors' "repair work" after the downturn. Therefore they discuss the role of niche internal processes and of external developments in that change. "Repair work" takes place when learning processes from specific projects, aggregated into generic lessons, produce outcomes that are below expectations. In these circumstances actors use the lessons learnt to redirect promises in directions that stand a better chance of success, e.g. are more adjusted to (re-evaluated) technological possibilities, and formulate new expectations whose contents incorporate these new directions. While their main focus was in the internal learning processes, the authors also found that changes in the contents of expectations were equally influenced by processes external to the niche. The new/adjusted expectations provide direction to subsequent activities and are used by actors to attempt to rebuild the networks and gain again access to resources.

These authors further argued that changes in expectations that address specific aspects of the technology, and thus support agenda setting at the technical level, are more clearly driven by internal learning processes. Conversely, changes in expectations about functionality of the technology, which support the definition of the functions the technology/niche will fulfil (global niche expectations), are more likely to result from linking internal learning processes with external developments. We would add that changed "global niche expectations" can also potentially encompass changes in the way the technology contributes to address major societal problems (e.g. what Ruef and Markard (2010) described as frames). This clarification is important because the scope of changes introduced may differ in that case. The distinction between the contents as well as the sources of expectation changes is relevant, because it supports a more precise analysis of the nature of the actions and interactions that can take place along this process.

2.3.2. Recovery in practice – strategies and actions

This conceptual approach provides a comprehensive outline of the processes that underlay the rethinking of the technical search activities (cognitive rules) and the revision of expectations, and result in new (shared) directions for development, which can support the re-establishment of support from external actors, including policy makers. This outline offers a useful a framework for a more detailed examination of the actual behaviour of the actors involved, namely permitting to distil and organise the variety of actions and "strategies" described in the expectations literature.

One first aspect concerns the fact that change in expectations contents result from deliberate learning processes taking place within the community of actors that form the emerging system, and that these learning processes entail greater or lesser interaction with the external environment. We believe that it is important to give greater attention to these internal learning processes, in particular the aggregation activities (Geels and Raven, 2006; Geels and Deuten, 2006), which are often overlooked in the discussion about system recovery. Aggregation activities are purposeful activities that turn the contextual knowledge generated by individual projects into abstract, generic knowledge that can be shared by the niche community and base de development of new visions and agendas. These activities are coordinated by some types of actors (e.g. collective organisations, individual organisations that move across projects) and are supported by dedicated "infrastructures" or "arenas" that provide a setting for the circulation and debate of ideas. These activities are described a driver for the process of change, but they are likely to continue over time, as the new promises and associated agendas are debated (and contested) and changed, both within the community and

particularly in the interaction between that community and the external actors, that will ultimately "select" some of them for support (Bakker and Budde, 2012)[1].

A second aspect concerns the diverse nature of changes in the contents of the expectations and thus on the directions they offer to future development, which can be directly linked with the types of "strategies" often mentioned to be adopted to achieve recovery. Geels and Raven (2006) draw on the already discussed differentiation between levels of expectations affected - devised by van Lente and further developed by other authors - and associated by them with the opportunities for recovery. Thus, it is possible to relate the levels of expectations affected, the changes in the contents of expectations, and the type strategies that system actors may need to adopt.

a. Changes in the contents of expectations that address **specific aspects of the technology** will be associated with **strategies centred on the technology**. The new expectations will be mostly about the technical performance of technology and will guide "local learning processes for solving specific technical problems" (Geels and Raven, 2006).

b. Changes in the contents of expectations that address the **functionality of the technology, when the framing of the technology remains mostly untouched**, will be associated with **strategies that are concerned with the positioning** of the technology and the socio-technical system around it, entailing a greater re-orientation of agendas. These strategies will tend to focus on what Baker and Budde (2012) describe as "enlarging the pie", which may encompass: i) enlarging the scope within the same niche, as when the technology is presented as potentially complementarity with a better positioned technological option that competes for same goals, thus sharing the same niche (Bakker et al, 2012); ii) expanding the potential audience, as when actors link with other technologies around a broader goal proposing that their efforts are complementary (Baker and Budde, 2012); iii) extending the range of opportunities, as when actors attempt to extend the potential applications to match with business opportunities in more industries (Van Lente et al, 2013); or when they link to other fields that are registering fast growth and thus can act as driver (Geels, 20015). In the first case, the strategy can defuse the threat posed by the competing technology and even profit from its dynamics. In the second case, the strategy may permit to benefit from a wider range of potential sponsors. In the latter case, the strategy also permits to capitalise on the identification of complementarities with adjacent or otherwise related industries (Markard & Hoffmann, 2016)

c. Changes in the contents of expectations that address the **functionality of the technology, when the framing of the technology is also affected**, will be associated with strategies that are concerned with the **reframing of the technology against a new set of goals**, entailing an even more substantial re-orientation. These strategies may also need to be combined with some of the strategies aiming at expanding the range of opportunities. The strategies for reframing expectations are likely to be the most complex, not only at the internal learning level, but also because promises may need to be voiced to a substantially different set of potential supporters also with implications for the alignment required to turn them into collective expectations.

Since changes in the contents expectations may involve more than one of these elements, combinations of strategies are likely to be required. On the other hand, while the different strategies for renewal of expectations and agendas are relevant in what concerns the attempt to regain policy makers support - since even modifications in promises and orientations at the

[1] Notice that what is "internal" and "external" is not static, rather changes over time.

technological level may reflect an intention to correct the problems that hindered development, improving the image of the technology – the two latter strategies are likely to be more effective to attract their policy actors' interest. Extending the range of opportunities can provide a better value to the technology which is something prized by policy makers. Framing the technology against new goals is likely to be particularly pertinent to policy makers, especially if disappointment was at the frame level, in which case reframing can be indispensable to regain attention and legitimacy (Norman, 2015).

A third aspect concerns the actual process through which the new visions and promises are voiced and shared (and ultimately "selected") not just within the system community, but in the wider environment where technology promoters and potential external supports interact. In our case, we are particularly concerned with how actors convince policy makers of the value of their promises and elicit favourable political decisions towards them, also guaranteeing that the directions set in their agendas are reflected in the policy strategies and instruments.

At this level the by Bakker and Budde (2012) concept of "enactors" and "selectors" who interact in a variety of "arenas" is particularly useful. Enactors are the actors that develop and actively promote the technologies, i.e. what we call system actors. Selectors are external actors that assess the various promises and ultimately select some, on the basis of their credibility and also their perceived value to them. While the authors warn that some actors may move between positions, policy actors are clearly selectors and their decisions will be particularly relevant since they will base policy support.

Enactors and selectors interact at a variety of settings – the arenas of expectations – where expectations are voiced, tested, negotiated, accepted or contested, modified. These arenas have been described as encompassing a wide variety of settings: events such as conferences, scientific or practitioner oriented, scientific journals, the media, or more organised activities such as scientific or expert committees or foresight exercises such as roadmaps (Bakker et al, 2011; Kinrad and Alvial-Palavicino, 2017). Collective expectations will emerge from these processes.

Policy makers have been found to play a very important role in these processes, since they can have a strong influence on the assessment and selection processes that take place along them (Bakker et al., 2011; 2012). They have equally been described as receptive to the outcomes of these processes, in what they to aim to synchronize policy designs with collective expectations to ensure credibility (Kriechbaum et al 2018). Although there is limited research focusing on the interplay between formation of expectations and policy formulation, for instance Levidow et al (2014) found that collective expectations had been shaped by interactions between system actors, policy makers and experts in specific arenas, and that system actors contributed to expert reports with visions of future development and the requirements to achieve them. These processes led to the selection of some expectations, which justified policy decisions.

Thus, in periods when expectations about the technology are not anymore part of a "collective repertory" (Baker and Budde, 2012), and when changed expectations need to be voiced and selected, system actors have the greatest interest in using a variety of arenas to target policy makers, in order to persuade them of the value and credibility of the promises and, perhaps as importantly, of their match to political goals. Moreover, since the collective sharing of positive expectations of the technology is a process that unfolds over time, the capacity to induce policy makers to start developing some political actions towards the technology - even if these are only in the form of formal assessments (Melton, 2016) - can signal to other actors an increase in expectations of policy actors (and thus in legitimacy). Since expectations held by policy makers have an important influence in the formation collective expectations,

particularly when they are reflected in some political decisions (Kriechbaum et al, 2018; Melton et al., 2016), this could have positive impacts on the overall position of the reconfigured expectations and influence recovery of support at other levels.

2.3. Conditions for success of actors efforts

The literature stresses that these efforts are enhanced by the credibility of the actors voicing the expectations (Bakker et al, 2012). In case of policy makers the presence of large incumbents was found to reinforce that credibility (Temmes et al, 2013). However, transitions research has consistently warned that the involvement of incumbents with these new technologies is often fraught with ambiguity (Smink et al, 2013; Bergek et al, 2013), and that they may use their position of power to steer the collective debates conducted in these arenas and the policies being formulated, in directions that better match their interests (McDowall, 2012; Geels, 2014).

As it has already been pointed out, backing promises with innovation activities reinforce their credibility (Konrad et al, 2012). Thus the capacity to start conducting new innovation activities already under directions proposed – if the field remaining structure allows it – can strengthen the efforts being conducted to expectations level.

This leads us back to the already discussed factors that influence recovery after disappointment, to conclude that the actors chances of success in their recovery work also depends on situational conditions, such as the constellation of actors and the level of instutionalisation of the field. In fact these factors can, on one hand, create better or worse conditions for innovation activities that back the new promises and, on the other hand, can provide the collective institutions and actor networks that are better prepared to assume the "enactor" work, as well as the credible internal champions and external allies (e.g. with more powerful organisations) that may support the claims. Finally, actors' efforts will also be conditioned by the nature of the political processes, namely the way policy formulation is conducted in the particular country, since this will condition the degree of influence of the technology agendas in the actual policy contents (Meadowcroft, 2009).

2.4 Towards an analytical framework

As become evident from this analysis, policy support is a critical form of protection for emerging technologies that are still faced with great uncertainty and thus, when disappointment regarding their progress sets down, its continuity was found to be determinant for recovery. When policy support is also removed system actors face a particularly serious situation and thus it is important how to restore such support.

The above discussion enables us to put forward a number of propositions concerning the conditions in which system actors can restore policy support, and in this way also create better conditions for system recovery.

One **first point** concerns the need to understand the **motives behind withdrawal of policy support** (i.e. the source of disappointment). This is important because these motives influence subsequent policy maker and because such understanding can provide some direction for recovery efforts.

Our proposal is that the withdrawal of policy support is likely to be associated with a combination of disappointment at the generalised technology level and the frame level. This is

because, in what concerns policy makers, the technology's inability to fulfil the expectations for the field (expected potential, scope of applications, commercialisation horizon) is also likely to affect its expected contribution to broader societal goals, thus affecting policy makers' faith in it as solution to achieve these goals. In fact, it can be argued that, if disappointment of policy actors was only at the level of generalised expectations, this might lead to the promotion of actions aiming at an assessment of the nature of the problem and at formulation of more realistic expectations, leading to a re-direction the innovation activities. That is, other forms of policy intervention rather than (quasi)abandon. Severe reduction or withdrawal of support suggests that the legitimacy of the technology was lost, whether because it was not anymore perceived as matching the goals, or because the goals had changed, e.g. in a situation of government change. This abandon might also be related with a situation where alternative technologies emerged as better solutions.

The implications is that recovery of policy support is likely to entail not just an adjustment/ rephrasing of promises about the technology as such, but also the reframing of the technology in what concerns its fit with broader societal goals. Thus, technology actors need to act at both levels.

A **second point** concerns the **conditions in which policy support can be regained**. The literature identifies factors, besides policy support, that favour recovery after disappointment. These factors have been described as being critical to a process that involves: rebuilding promises and expectations around reformulated development agendas and eventually also new frames of reference; mobilising them to re-attract attention and support to the emerging field, thus permitting to engage in a new process of network expansion and innovation investment.

It is proposed that factors are equally pertinent to restoring policy support and thus can be fruitfully mobilised to conduct an analysis of the processes that enable to regain it. At this level it is important to consider two types of factors: related with actors' agency and situational. The former are related to the "recovery work" being conducted by core actors in order: to rethink the development process, to adjust promises and reconfigure expectations and agendas; to communicate and share these expectations; to re-organise innovation activities. The latter are related to the conditions in which these activities are developed, which depend on the situation of the emerging system when the disappointment set down, namely in what concerns: the level of expectations affected by disappointment; the constellation of actors that compose/support the system; the level of institutionalisation achieved prior to disappointment; as well as the broader political and economic situation. The literature provides some insights into how specific features of the political process affect the interplay between system actors and policy makers in the process of reconfiguration of expectations and selection into political agendas. However, there is still limited research at this level, and more detailed analysis of empirical situations may nevertheless be required to better configure the nature of these processes.

A third point concerns the ways in which **restoring policy support can contribute to an overall increase in positive expectations, with impact on system recovery**. It is proposed that, since policy level expectations and decisions have an important role in shaping collective expectations, the ability to regain policy makers attention to a (new and improved) vision of the technology and its potential outcome in the form of renewed policies, will contribute, over time, to overall system recovery. However, what we know about the dynamics of policy making suggests that this can be a slow and interactive process, with effects taking place at one level influencing the other in a process that can be described as co-evolution, and that is not necessarily linear.

The rationale is that along this process, actors strategic behaviour, by conducting recovery work at system level (in terms of activities and discourses, including policy lobbying) may bring about a change in policy makers views on the value of the technology and thus a raise in political attention, which may lead to new policy actions related to it (assessment of situation, re-framing of field potential contributions). These may increase legitimacy, thus attracting new attention to the field from other external actors, while also contributing to lessen negative views on its future potential, e.g. making positive expectations more widely shared. Such effect may be potentiated if the recovery work involved expanding the field scope or linking it with faster growing fields. A renewed interest in the technology, and/or its association with more promising fields may further convince policy makers that the new directions are worth pursuing. As a result, they may introduce new policies that acknowledge their relevance and support their development. Depending on their lobbying capacity, system actors may be able to have a greater or lesser influence in the actual policies formulated and in their implementation.

In addition it is argued that this process can be accelerated (or slowed down) by the way external events (at landscape level) or broader policy processes unfold (particularly if these had an impact upon the downturn/disappointment to start with). For instance, changes in economic conditions may increase availability of resources and drive new government investment policies; while government changes may influence the broader goals against which expectations are framed. While these events are outside system actors reach, they can profit from the opportunities provided, for instance timing their interventions or matching visions of technology futures to the new goals.

In summary – this paper argues that, when policy support is lost its restoration is a critical step to recovery. Thus it is necessary to understand how it can be regained. For this, it is necessary to consider: i) the system side – i.e. how system actors act, as part of their recovery work, to achieve this objective, and which are the system conditions that favour (or hinder) their actions; ii) the policy side – i.e. how policy actors react, and how the outcome of their decisions influence the recovery work; iii) and whether and how the interplay between those system and policy dynamics induces a process of overall system recovery.

This discussion provides the basis for an analytical framework that will be developed in the next section and subsequently applied to the empirical analysis of the case of ocean energies in Portugal.

3. Methodology

The paper aims to understand how policy support was regained after disappointment and policy withdrawal, focusing on the behaviour of actors from the emerging socio-technical system and of policy actors and on their interplay over time. It also aims to understand whether and how the processes that led to regaining of policy support also induced overall system, recovery. The final objective is to identify factors and actor strategies that enable recovery after disappointment when disappointment also affects policy actors and thus has a negative impact on policy support, which has to be regained.

3.1 Analytical framework

The discussion conducted in section 2 provides the basis for an analytical framework, which can contribute to uncover the factors that enable recovery after disappointment, when disappointment also affects policy actors leading to withdrawal of policy support.

Dimensions of analysis:

a) Expectations affected and implications for recovery:

- Policy makers – motives for disappointment influence subsequent behaviour
- System actors – nature of changes in expectation that are required influence recovery work

b) Behaviour in the system side

Recovery work by core actors

- Internal learning processes
- Strategies deployed to renew expectations
- Processes for voicing and sharing expectations
- Opportunity to conduct innovation activities to back promises
- Alliances/credible actors

Situational factors that condition actors' recovery work: how was the system after disappointment:

- How institutionalised
- Which constellations of actors
- In which environment it was embedded (economic, social & political)

Recovery work by core actors

- internal learning processes (aggregation activities)
- strategies of expectations renewal adopted
- practices for voicing expectations (in particular towards policy makers)
- evidence of innovation activities to back promises
- alliances

B) Behaviour in the policy side

Extent of disappointment (outcomes)

- Level of expectations affected
- Degree of alignment between governance levels
- Extent of impact on policies (to which system actors can resort)

Policy contribution to conditions that can affect system recovery work

- Policy adjustment in answer to broader developments at economic or social level (external shocks)
- Political processes (e.g. government changes)

Activity as selectors

- Involvement in arenas
- Policy decisions

Policies formulated

Table 1 – Framework: dimensions

System side	Policy side
Type of change in expectations required (related with level of expectations affected)	**Extent of disappointment** - **expectations affected** - governance levels - extent of impact on policies
Situational factors that affect recovery work (dynamic) - Situation after disappointment: - **level of institutionalisation** - **constellations of actors** - **environment it was embedded** - **external shocks**	**Policy contribution to conditions that can affect actors** - **Policy adjustment to broader developments (external shocks)** - **Political processes**
Recovery work by core actors - **internal learning (aggregation) (linking with external environment)** - **expectations renewal strategies adopted** - **practices for voicing expectations (in particular towards policy makers)** - **evidence of innovation activities to back promises** - **alliances**	**Evidence of activity as selectors** - **Manifestation of interest/ involvement in expectation reframing process)** - **Policy actions as selectors (e.g. assessment and expert consultation) in a variety of arenas**
Reaction of the system to early attention of policy makers as selectors (Networks; nº projects; new firms, etc.)	**Policies formulated**
Reaction of the system to actual policies (idem)	
Interplay system/policy	
Evidence of actions taking place at one level affecting the other	
Actions and conditions described above may evolve as a result of this interplay and the outcomes feed back into the process potentially changing the contents of some dimensions	

3.2 Data and methods

The empirical research addresses the processes that took place in Portugal, over the past two decades, aiming at developing a set of marine renewable energies and building an "ocean energy system" around them. It focuses on the processes that took place in the period of disappointment that followed the hype (i.e., the period 2010 onwards) and which was aggravated by the impacts of the economic crisis that hit the country strongly the early 2010s.

Previous analysis of this system (Fontes et al, 2016) identified a number of periods in the development of these technologies and the formation of a socio-technical system around them, based on relevant changes in system configuration. For our purposes only two of these periods are relevant, but we also add a new period that corresponds to more recent developments:

- 2006-2010 – High expectations
- 2010-2014 – Disappointment & uncertainty
- 2015-2018 – Tentative recovery

These periods are concerned with the evolution of a socio-technical system that started centred around wave energy technologies (from the early 1990s); registered the emergence of a new technological option – floating offshore wind (in the late 2000s) – that assumed an dominant role after the hype and disappointment, which was largely focused on the wave energy option; and evolved towards a combination of these two technological options under the label of "ocean energies". In this paper we focus on the processes that took place in the two last periods, referring to the former when it is relevant to understand the sources of disappointment.

The research adopts an historical perspective and uses interpretative methods to examine: i) the processes conducted by core system actors to mitigate the damaging effects of disappointment that resulted in withdrawal of policy support, and to achieve recovery, with particular emphasis on the actions aiming at restoring policy attention and policy support, (which was regarded by these actors as critical); ii) the processes that took place at the policy level that resulted in changes in behaviour of policy actors, as reflected in their policy decisions towards the technology; iii) the evidence of an interplay between actors at both levels, as well as of impacts of actions taking place at one level on the other; in particular eventual wider impacts of policy decisions (reflecting change in policy expectations) on the system "image" towards other external actors, and on innovation activities.

The analysis of the policy side is based on policy documents and interviews (conducted in 2015-2016). The analysis of the system side draws on previous research on the development trajectory of wave energy and offshore wind in Portugal (Fontes et al, 2016; Fontes, 2017; Bento and Fontes, 2017) and extends it to encompass the recent evolution. This analysis draws on a broad set of data, including primary sources (interviews with the main system actors, repeated over time) and data on the documented actions conducted by system actors, or other actors temporarily associated with the system, in several domains – e.g., R&D and experimental activities, business activities, alliance formation, collective activities, etc. obtained from secondary sources (databases on national and European project and patents, websites and other organisational information, technical reports, specialised magazines, press releases, etc.). In addition data was collected on events that took place during this period, targeted to or encompassing the technologies/system under analysis, from the initiative of either system actors or policy makers, including the participation in some of them.

While the focus is on the processes that took place in Portugal or involved Portuguese actors, we acknowledge that the development of marine renewable energy technologies is a process that transcends country boundaries, encompassing communities and actions that span several spatial levels (Fontes et al, 2016). This is particularly evident in the case of Portugal: wave energy actors have been among the pioneers in the field and have, from very early stages, engaged in the activities conducted at various spatial levels, belonging to a variety of international networks and supra-national institutions; the floating offshore wind activities are being largely conducted by an international coalition. Thus evidence on the multi-spatial nature of the activities that has impacts upon disappointment and recovery at country level is relevant and will be also part of the analysis.

4. Empirical analysis

4.1 Overview of the evolution of the system: early development, hype and disappointment

In Portugal, the development of marine renewable energies has been part of a process that led to a transformation of the energy system, through the development and large scale introduction of renewable energy technologies (RET) in the electricity system. This process started in the 1990s, with major changes in the structure of that system (termination of monopoly, market liberalisation). But it effectively took-off in the early 2000s with the definition of national strategy for RET and the introduction of specific policies to support their development and diffusion.

The introduction of renewable technologies in the energy system and the creation of a renewable energy industry became a strategic goal at country level. Over time targets were set, policies (both supply and demand) were launched and specific regulatory changes were introduced, creating a favourable environment for the development and diffusion of the new technologies. This diffusion was largely based on technologies closer to maturity, in particular onshore wind, which reached a very high level of penetration. But the generic policies and regulatory framework in place were equally applicable to less mature technologies, which have also benefited from them. However, in the early 2010s, the economic crisis and country bail-out and the associated political changes, led to major changes in the government strategic approach to RET. In the new economic and political context they were relegated to a much less central position, leading to some instability in what had been until then a relatively stable supportive environment. As economic conditions evolved and political situation changed, after the mid-2010s, RET started to regain a more central position on the government strategy.

Among the marine renewable energy technologies, *wave energy* was included relatively early in the "package" of RETs to be developed. The early relevance of this still emerging technology was associated to the fact that substantial scientific and technological competences in the field had already been developed by a small but proactive community, with a strong position in the international scientific networks. Thus wave energy benefited from the government strategy and policies in parallel with other RETs, even if the slow development of the technology constrained its progress and visibility. But, in the mid-2000s, the government started giving greater attention to this technology, which was then regarded as combining the capacity to address environmental goals, by representing a new generation of renewable energy technologies that extended the variety and scope of clean energy production; and also industrial development goals, by potentially driving the creation of a new economic activity, which could also bring about the revitalization and transformation of existing sea-related industries (often traditional or declining). The growing importance that started being attributed to the creation of a "sea economy" reinforced this view.

Thus, a strategy for wave energy was then then formulated, which aimed at the development of a "prime mover" advantage in this field - drawing on established competences and favourable natural conditions - and which articulated what was at the time a relatively pioneer approach to the development of the field. This resulted in the formulation of a policy-mix for the field, which was complementary to instruments already active for RET, or for R&D and innovation in general. Optimistic targets were set; several elements of a wave-specific regulatory framework started being established; infrastructural conditions for the setting-up of experimental, pre-commercial and commercial activities (a Pilot Zone operating as one-stop-shop facility) started being developed. The final goal, explicitly coined in policy documents, was to create national competences, develop an industrial cluster and contribute to revitalise and upgrade traditional industries.

The favourable environment thus created motivated several actors, both national and foreign, to engage (or propose to engage) in a variety of activities in the wave energy field. These ranged from technology developers, to large incumbent companies, both utilities and established companies that had already diversified to other RET (something they regarded as a positive experience), to firms in complementary areas along the value chain. There was a brief period of high expectations and intense activity. However, technology performance results much below the (too high) expectations, combined with delay in the actual concretisation of some of the policies/facilities proposed, forced several technology developers to abandon their projects and led to disappointment among both investors and policy makers, substantially reducing the fields' legitimacy and its attraction to non-core actors. The financial crisis hit the final blow, since those problems were compound by actors' financial difficulties and by changes in RET goals and policies, in particular the withdrawal of policy support to "immature" energy technologies. Projects stopped and most dedicated companies closed down. The field entered in a period of serious decline. It is relevant to point out that disappointment towards wave energy was not exclusive of Portugal, but hit the small group of countries that had engaged in this field. However, its seriousness and the responses to it varied across contexts. In particular there was a relatively less radical attitude at the supra-national governance level composed by the European Union, where mitigation actions were developed.

Offshore wind appears later in the process. Contrary to wave energy, there was practically no activity in this field in Portugal (although there was intense activity in onshore wind) until the decision of a large domestic utility to launch, in the late 2000s, a project to develop a new technology. This was an emerging technology - a floating system - and the expectation was, once again, to achieve technological and market lead. The genesis of this project was contemporaneous with the period of high expectation in wave energy – indeed its promoter was then also active in that field – and it was also regarded as contributing to the goal of creating a sea-related industrial cluster. But, its actual development already took place by the end of the decade, when wave energy was experiencing problems, and coincided with a period of financial crisis and government divestment in RET. However, contrary to wave energy, this technological option presented very positive results in a relatively short period, which permitted to sustain the expectations regarding its development and thus to retain some support, even if the contextual conditions were not very favourable.

This brief overview enables us to situate the technologies in the context that ultimately to the hype and disappointment, and also gives some indications on the conditions that led to such disappointment, as well as on the situation faced by the technologies when disappointment set down. In the following sections we will analyse in greater detail the processes that took

place in the periods we labelled as “Disappointment & uncertainty” (2010-2014) and “Tentative recovery” (2015-2018).

4.2 Disappointment, its impacts and actors reaction

4.2.1 Policy level – motives for disappointment and their influence on policy withdrawal

In order to understand the motives for policy disappointment is necessary to go back to the peak of the hype, when the expectations that had been growing and some particular promises made by technology developers started influencing the policy actors’ behaviour. In fact, at some point there was a change in the government attitude towards the development of wave energy, which had so far favoured a staged approach to the development of a variety of different technologies at different levels of maturity. There was a visible pressure for achieving fast results which meant that the previous approach was largely overlooked, and political attention focused on one project that promised immediate commercial outcomes and become a “flag project”. This move was followed by several large industrial actors, which shared the high expectations and were possibly further encouraged by the strong government endorsement.

This political option effectively left the system “hostage” of the performance of this system which had a detrimental impact upon subsequent developments. The failure of that “flag project” – whose highly politicised launch had received strong media attention - had a strong impact, effectively driving a process of disappointment at political level and immediately slowing down the setting-up of the policy instruments still under implementation. This behaviour configures a case “bandwagon and circus dynamics” (Verbong et al. 2008), as the strong impact failure of the flag project (which was also widely discussed in the media, at both national and international level) was highly detrimental to the image of the actual policy department and to his claims about the technology contribution to industrial development.

But an external shock, in the form of the financial crisis, was an additional element to underlay policy withdrawal. The financial crisis, and the change of government that it brought about, had a profound impact on the broader country strategy regarding RETs, driving major changes in that area, that stopped being strategic. In the case of wave energy, the combination of an “austerity policy” that rejected technologies without commercial value, with the recent evidence of actual distance from that commercial value, made support even less politically justifiable.

The above metaphor of bandwagon and circus dynamics can also contribute to explain the policy makers’ attitude towards floating offshore wind, the new technology option that emerged in the previous period - although relatively obfuscated by the focus on wave energy I the peak period. At a moment of growing disappointment with the technology where all bets had been made, policy makers regarded the new option, whose expectations were being fulfilled, as way to try to retain some of the political promises being made. Thus policy makers “jumped in the new wagon” that offered better promises. However, the advent of the financial crisis reduced the resources available and the political changes also altered attitude of the government department responsible for the energy domain towards RET in general. Thus, while the expectations on the technology at the system level were maintained, and while it retained some of its political legitimacy, the political context was not completely favourable. Nevertheless the credibility of the technology promoters – in particular of the large energy utility – meant that some support was maintained to this particular technology, not necessarily in the form of a comprehensive policy mix as in the previous period, but more precisely in the form of had-hoc legislation that solved problems that emerged in project development and

some investment subsidies. Interestingly some of this legislation would also be applicable to wave energy.

Thus, concerning the causes underlying policy withdrawal, in the case of wave energy, we observe a combination of frustrated expectations at both technological and frame level, with the effects of an external shock that led to reduction of resources and broader political reorientation where this type of technology hardly fit. The result was an almost complete halt on policies directly related to wave energy and an effective policy divestment in the field, clearly expressed on a great reduction of the long term wave energy target. In the case of offshore wind, the fact that expectations remained intact permitted the maintenance of some support, even if the effects of the external shock limited the opportunity to fully reflect these expectations in more extensive policies. However, this meant that the new technological option become dominant in terms of policy attention, which increased its legitimacy.

4.2.3 – System level: actors answer to disappointment

A combination several factors meant that the "trough of disillusionment" was particularly serious in the wave energy field: disappointment among investors resulting from unfulfilled expectations regarding the technology that led to their abandon; deceleration and halt in the implementation of policies previously announced and more generally evidence of removal of policy attention signalling loss of legitimacy to other actors; and finally, the subsequent impact of the economic crisis on the activities, which contributed to aggravate the negative effects already at work. The result was a deep crisis, manifested through a sharp decrease of activity in the wave energy field and the shrinking of the emerging system.

Situational factors – situation after disappointment

Thus, in in what concerns the institutionalisation of innovative activities, wave energy was left with an only residual level of investment. This situation was greatly related to the low "genuinity" of the promises made by a substantial number of actors that entered the system during the hype and never materialised them, abandoning immediately after disappointment. The failure of most local technology developers with very incipient technologies, due to lack of both private and public support was an additional problem. Only one experimental project, of the initiative of a foreign developer, remained active, although experiencing investment problems. Innovation activities had also relied strongly on foreign technology developers, who were highly mobile and tended seek for other locations (when not equally affected by the crisis).

However, two elements remained, which nevertheless enabled to sustain some innovation activity. One was the continuity of research and development activities conducted by core scientific community. This was only possible due to European Union funding and to the extensive actors' involvement in international networks that enabled participation in additional projects. The other was the activity conducted in the context of the alternative technology option that survived relatively unscathed – floating offshore wind - which had some important synergies with wave energy. The positive expectations around this project permitted to attract external actors - including some that had already been in the wave field - into the experimental activities that continued to register positive results. It also enabled some wave energy actors to become involved in projects that combined the two technologies or addressed issues relevant for both.

Nevertheless the field was largely reduced to the core actors. These included: research organisations, in particular a group of scientists who had a driving role in the early stages of

development field and maintained it over time and who had, in some cases, also been involved in experimental through their spin-offs or in the context of projects with (mostly foreign) companies; the large utility and its partners; and the collective organisation that had been formed in the mid-2000s, joining the main actors then operating in the field and which had been always highly proactive, promoting its activities and lobbying on its behalf.

These actors were instrumental in the subsequent recovery work, by engaging in the renewal of expectations and voicing and debating them in a variety of arenas, including the extensive efforts to get the attention of policy makers.

In addition, the international networks formed by scientists and technology developers were an essential element, in a field in which activities are often distributed across organisations in different countries. They were not just important for the maintenance of innovation activities but also for the rethinking of the technology, as will be discussed below.

Role of internal learning process at "global level" in the renewal of expectations

The involvement of core system actors in supranational activities was also instrumental for their involvement in internal learning process concerned with rethinking of the technology (both in terms of technical problems and technology functionalities) and with changing the contents of expectations, at field level - or at the "global niche level" – that started being conducted in these networks as a response to the difficulties that had been identified. Similarly the extensive involvement of Portuguese actors in institution building at European level was critical for the process of renewal of expectations. In fact, these networks and organisations were instrumental in the conduction of "aggregation activities" that produced the outcomes supporting the formulation of new expectations and agendas, which were partly global and partly adapted to the specific context of each country. They also had an important role in the process of sharing of these expectations, not only within the "internal community", but also towards external actors, in a variety of arenas, bringing their credibility into the process. This credibility was important to their acceptance by the European supra-national organisations. The active participation of Portuguese actors in these processes was critical to inform their recovery activities at country level, as well as to increase the credibility of the promises towards domestic policy makers.

Core system actors engaged in learning processes similar (often parallel) to the ones taking place at global level, simultaneously drawing on the results these were producing and conducting activities that enabled learning processes and reconfiguration of expectations adjusted to the specific conditions found in the country. These activities, within the community and in interaction with the external environment effectively, resulted in a process of change of expectations contents, which encompass some of the types of strategies described in the literature

Strategies adopted in the renewal of expectations

The repair work conducted by during the period immediately following disappointment was influenced by three main sets of developments. One was the perception that the technology had lost its legitimacy as contributor to a clean energy transition as a major policy goal. This meant that the technology had to be reframed towards a different goal. The other was the emergence of floating offshore wind, which had been perceived by wave energy actors as a competitor for attention and resources, but had, over time, started being regarded as potentially complementary, meaning that the exploitation of the synergies between started being perceived as a potential route towards recovery. Finally, the other was the perception of

a greater receptivity to marine energy technologies among policy makers from the Sea domain, who had not been as heavily involved in the hype and disappointment process and thus had been less affected by disappointment. This policy domain had the advantage of having maintained a strategic position at country level. Moreover, the goal of building a "Sea Economy" had led this policy domain to start identifying the new activities that could contribute to this goal, and "ocean energies" had emerged as one of them.

These conditions shaped the strategies adopted towards the changes in the contents of expectations. These strategies involved, first of all, linking the declining technology option (wave energy) to the rising one (floating offshore wind), thus extending the scope of the system under a new umbrella – ocean energy technologies. This move had the added benefit of bringing a powerful actor as promoter of the new configuration. For wave energy the benefits of this association overcame the risks of obfuscation or absorption. This is indeed a risk since the joint-packaging of two technologies that are in different stages of development and are promoted by diverse category of actors can have a detrimental impact in the future development detrimental to the weaker one (Vantoch-Wood & Connor, 2013), even if guarantees its survival in the short/medium term.

This broader configuration permitted to strengthen the other strategy, which involved the reframing of the technology against new goals. The expectations for the "ocean energy technologies" linked them more decisively to the construction of the Sea Economy, not just as a new activity but also as contributing to the development and revitalization of other sea-related industries. This followed a movement also visible at European level, but adjusted it to the local conditions.

The association with the Sea entailed one further strategy, which involved enlarging the range of opportunities, by linking the technology with a field registering fast growth that could act as act as a driver; and also matching the technology with business opportunities in a wider set of industries.

Finally, we should also take into account the extensive learning processes focused on technical level problems – mostly resulting from the already mention aggregation activities at "global niche level" - which led to the formulation of expectations about technical performance and resulted in the definition of new search directions at that level. Several of them were adopted in European level programmes and become guidelines for action increasingly followed by actors in their innovation activities. In addition, the system actors, in particular the collective organisation, also attempted to address some of the non-technological obstacles that had been identified in as major inhibitors of development. For instance a guide for good practices concerning the consenting process was produced and research activities concerning the potential impacts on marine life were equally developed.

Thus, it is possible to conclude that changes in expectations addressed all expectations levels and involved a wide range of strategies

Actions to formulate, voice and share the renewed expectations

A variety of actions took place over time, in diverse "arenas", both within the "community" of system actors and in exchanges between system actors and external ones, in order to formulate the new promises and to voice, negotiate and share them. Possibly the most relevant of these actions was the launch of a roadmapping process, of the initiative of the actors and with limited government involvement (OTEO, 2014). The process of Roadmap formulation, diffusion and debate was aimed at achieving two important goals: a major re-

orientation of system, to which they were willing raise the interest of a different set of external actors; and the attraction of government attention to the new set of promises being put forward. In particular they were already attempting to reach policy actors from a different policy domain than energy.

The Roadmapping exercise crystallised the renewed expectations and attempted to widen the range of actors that shared them. An example of this was the fact that one important goal focus of the Roadmapping exercise was a detailed examination of the conditions for the formation of a new "value chain" and its relation to the existing (sea-related) industries - can be viewed as the materialisation of the two main strategies for expectation renewal. This was followed by a variety of actions with that same objective: organisation of conferences and specialised workshops and constant presence in events where these ideas could be propose to a broader sea related audience, articles and some attempts at direct policy lobbying. The efforts started raising some among actors (particularly in collective ones) from the sea area – e.g. a new Cluster Platform for the Sea (Sea Knowledge and Economy Cluster) encompassed ocean energy as one element.

The attempt to capture government attention were evident in the documents produced as part of the Roadmapping process which explicitly mentioned that the vision expressed in it needed to be "adopted" by policy makers, and indicated a number of areas where government intervention was necessary for achieving the goals defined.

Innovative efforts that already followed the new agendas derived from the renewed expectations were important to increase the credibility of the promises made. These efforts were not exclusively concerned with technical issues, but also entailed the interplay between the interdependences between the two technological options or the potential complementarities with technologies or industries that were encompassed by the expanded focus on the Sea.

Impact of recovery efforts at policy level

The work conducted for and as a result of the Roadmapping exercise was important at system level for achieving external actors (re)engagement, but they appear to have had a limited political impact. The government did not express an interest in endorsing the proposals or discussing the results, even if some had-hoc legislation produced afterwards have responded, to a limited extent, to some needs expressed in the policy recommendations.

In fact, it is possible to conclude that during this period, any policy attention to the renewed expectations and the efforts to communicate was come mostly from some government agencies and individual policy actors in sea related departments, but appeared to have a relatively limited impact in the higher policy echelons and thus on the actual formulation of the policy specific for the field. There were nevertheless some indications that some ideas were passing – such as the inclusion of "ocean energies" in the revised version of the National Strategy for the Sea and Action Plan that was produced in 2014. This attention was also possibly influenced by European level policies: a Blue Growth Strategy, which included Blue Energy as one of the pillars and Blue Energy Action had been launched. This recognition of a role for the ocean energy technologies was an important step, even the emerging technologies potentially producing impacts in the medium/long terms, remained in a marginal position in area where other sea-related activities have an intense economic activity and/or pressing problems.

In any case it indicated that the results of the efforts were making some way, albeit slow into that political area and the respective government departments. This contrasted with the persistent disinterest of the Energy political domain, whose involvement continued to be was almost exclusively concerned with removing occasional obstacles to the offshore wind project. It is possible to argue that in the political context of the period, the lack of maturity of the technologies and their distance from the market, in a context where other RETs were already diffusing, gave the field low visibility and limited political relevance. However, the continuous political disengagement of the energy area – even if moderated by the support awarded to the incumbent initiative – was still problematic. Given the responsibility of this government area for some of the processes relevant for the activities in the field, its behaviour inhibited the development of some activities and precluded a needed coordination with the sea domain.

But there attention was also gained from another policy level - local government. This was the case of regions where experimental projects had been implemented at some point and/or where the offshore wind project and the surviving wave energy project developed their experimental activities, which perceived the benefits for the local industry. This was particularly relevant in the case of wave energy, whose promoter benefitted from the continued support of the local authority, particularly relevant at a period when the central government had lost interest and was especially wary of wave energy technologies. The interest of this government level was materialised in the design of the Regional Smart Specialization Strategies (RIS3). A number of regions included ocean energies in their priority areas, frequently as part of a package of sea-related activities, but in a couple of cases already emerging as a stand-alone activity.

It can be concluded that the growing association of ocean energies with the sea as a major societal challenge enabled the field to recover some political credibility and to maintain some activity. Even if the processes were slow, at it was possible to observe a change in system dynamics due to actors' efforts towards the reconfiguration of expectations and their extensive communication in a variety of arenas, as well as their performance of innovation activities following the directions proposed. These changes offered some credibility and permitted to regain some political interest, inducing some (albeit limited) political decisions.

However, a clear change in the attitude of policy makers at the central government level only occurred later mostly associated with a political change that brought about major alterations in policy orientation.

4.3 Tentative recovery

The new government that went into office in the mid-2010s, and particularly the newly created Ministry for the Sea revealed relatively early a more decisive interest in the development of this area, as part of the "sea economy" drivers.

In 2016 the government set-up an Inter-ministerial Working Group that also involved academic and industrial experts, including some key actors in the field, with the mandate to define a "model of development" for the ocean energies area. The resulting report "Guidelines for an Industrial Strategy to the Renewable Ocean Energies" was subject to public consultation, being widely promoted and discussed at a series of events, often organised by or with the presence of the Minister of the Sea.

While this process took place, the government maintained the production of *had-hoc* legislation that enabled ongoing projects – in particular the floating offshore wind project that remained a flag project, but also increasingly to less mature technologies that started to

emerge in the wave energy area – to pursue their activities, mostly by reducing administrative hurdles, regulating the conditions of electricity production, or addressing infrastructure issues.

The system actors profited from this new receptivity to reinforce their efforts to obtain a positive assessment of their renewed expectations and agendas in the new arenas created by the policy intervention, and ultimately guarantee their acceptance by policy makers and their inclusion in the "models" being devised. Thus, besides participating in the expert groups and in the events for debate of their results, they mobilised a variety of outcomes to strengthen their credibility. These included: the allies gained in the sea area and in other complementary sectors where they had started to develop joint activities, to back the promises made; the positive results achieved, not just in innovation activities along the new directions, but also past successes as pioneers in the field, to serve as an example of what could be achieved; a variety of supranational organisations, where they often occupied relevant positions, to bring added credibility to the options defended.

While the heterogeneous group of actors that currently compose the advocates of the system is likely to have different views on that model of development, some consensus appears to have been reached concerning the directions to be followed which were crystallised in a "Strategy and Action Plan for the Renewable Ocean Energies" that was launched by the government at the beginning of 2018. This document formalised a strategic option that, in practice, revisited the early goal of creation a new industry around the technologies (now extended to "ocean energy" instead of only wave energy), which would contribute to create of mobilise technological competence and to revitalise existing sectors. It also clearly positioned the ocean energies among the core contributors to the new "sea economy". Interestingly, despite the clear focus on the floating offshore wind project (that was presented as the first step towards a new "cluster") the strategies and discourses always include other technological options, in particular wave energy, and recognise the need of a differentiated treatment for less mature ones. Thus, even if there still appears to be a tendency to create flag projects, there is greater caution in not exclusively "picking winners". Nevertheless, the risk one again overpromising remains present.

This new strategic approach has not yet been translated into policy instruments, but the willingness to promote the development of this area as part of the "sea economy", consistently voiced by the Ministry of the Sea, and its materialisation in a sequence political actions, is sending a strong signal of government commitment, which has raised the attention of existing and potential actors. However, contrary to what happened in the mid-2000s, this had so far an only limited impact on actual activities or even investment proposals. There was some investment among the actors already involved in the offshore wind project and a slight recovery in wave energy - some new start-ups, manifestations of interest from some foreign technology promoters and an increase in R&D projects and experimental projects, mostly funded at European level. But, overall, a "waiting mood" seems to prevail, which may result from the lessons learnt in past disappointments.

Box 1: Disappointment period

System side	Policy side
Interplay	

Box 2: Tentative recovery period

System side	Policy side
Interplay	

5. Conclusions

This paper addressed the process of system recovery after a cycle of hype and disappointment, when policy support, a critical element in such recovery, has been lost and needs to be regained. Drawing on contributions from the sociology of expectations, innovation policy studies and socio-technical transitions literature, the paper discussed the factors that enable system actors to regain policy support, and how the interplay between actors recovery work and policy makers decisions, over time, can induce overall system recovery.

This discussion supported the development of an analytical framework that permits to investigate how these processes unfold. The framework puts together a number of dimensions – at the system level and the policy level - that are proposed to be key elements in the process of recovery and whose co-evolution is expected to produce outcomes that lead to restoration of of policy support and induce system recovery. This process is defined as slow and non-necessarily linear.

The framework starts from the requisite of uncovering the motives for policy disappointment and characterising situation in which the system was left when disappointment set in, as these set the conditions for the actions to be conducted by system actors and also for the potential reaction of policy makers to their efforts. It then defines dimensions to examine: the actors' recovery work to reconfigure expectations and ensure that they are shared and adopted; the policy actors' behaviour as potential "selectors" whose attention has to be attracted and that need to be convinced of the value of the promises made; the effects of the interplay between these processes as they unfold over time.

The framework was applied to the case of the system being built around marine renewable energy technologies in Portugal, which represent an exemplary case of hype followed by deep disappointment that entailed withdrawal of policy support. The empirical analysis provided some important insights into the processes that may lead to recovery that are summarised below.

One first insight concerns the motives for policy disappointment. The research confirmed our proposition that withdrawal of policy support is associated with disappointment, at both the generalised and frame levels of expectations. But it has also shown that other motives are likely to be at work, which are related to broader political processes, including policy makers reaction to events that are unrelated to the system. The implication is that a reframing of expectations into new policy goals is a critical step, but also that other changes may be needed before policy makers redirect attention to the system. The research has shown that the ability of system actors to achieve a wide acceptance of the reconfigured expectations among other external actors can be an important step in that direction, since they make them more valuable and credible to policy makers, justifying some attention. The capacity to conduct

innovation activities already under the new agendas is equally confirmed to contribute to that objective.

The implication of this is that the outcome of actors' expectations work outside the policy sphere is more important to set the recovery process ongoing than was initially thought. In fact this drive was proposed to come more distinctly from policy attention, given the importance of policy expectations and decisions on collective expectations. The type strategies adopted by system actors to change the contents of expectations were found to be an important element in that indirect process of getting policy attention. For instance the strategy that entails extending the scope to encompass other technology options that perform better was critical, permitting to combine under a broader umbrella a technology that had not been object of disappointment and that was promoted by actors with a strong power and political credibility. Similarly, the strategies that entail extending the range of opportunities by linking with other fields and industries were important to enrol new supporters. They were especially instrumental when that expansion was combined with a reframing of expectations, since it provided evidence that the new goals were being addressed (as was the case when new promises addressed the development of sectors that were a target of the government goals under the new frame – the Sea).

Finally, the process of gaining attention was found to be facilitated by the fact that different government levels had been differently hit by disappointment. At the supranational level there was continuity of support which enabled some continuity of innovation activities, while local governments in locations where experimental activities had been performed were interested in their continuity. On the other hand, it was found that receptivity could be greater in some government domains (for instance those more directly concerned with the new policy goals, e.g. sea vs. energy); and that these constituted an "entry point" through which the reframed promises could make their slow way into attention.

Another conclusion is that is effectively a slow process, and that even if some interest is revealed by specific policy actors and/or at some government levels, its effective translation into the policy agendas depends on the importance assumed by the goals against which they had been (re)framed in the overall political process. Thus it may be contingent to broader changes at the political level. However, it was also found that once attention is effectively gained, the extent to which the expectations and agendas are incorporated into the new policies, depends very much how widely shared they are, as well as on the credibility that system actors had gained among policy actors, that is, on the previous efforts that led to these outcomes.

The research has also found that government attention, reflected in the decision to start assessing and debating the value of the new promises, in a variety of arenas, with the view to formulate policies towards it – that is to act as selector - sends a strong signal to other external actors. These actors also start engaging in these processes, thus extending the overall attention to technologies and to the emerging system and contributing to the wider sharing of the expectations about them. Thus policy attention to the renewed expectations and early decisions relative to them are effectively a drive, but the route to obtain them may be more complex than proposed. Interestingly, in this case it was also found that, before actual policies are formulated, the interest of other external actors to the promises made is only to a limited extent converted into action, although it provides an incentive to internal actors. This may reflect a limited confidence in government promises, as a lesson from the previous hype and disappointment cycle.

Finally, in what concerns the actors' recovery work, the research highlighted the importance assumed by the internal learning processes and particularly by the "aggregation activities" defined by Geels and Raven (2007) in the reconfiguration of expectations. While these activities are not only conducted for the change in the contents of expectations – in fact they are a continued process along the trajectory of technologies – they were found to be particularly important in these periods, contributing to uncover the source of problems and to advance proposals of solutions. These were debated and negotiated within the system community in a process that also brought into it the outcomes of broader external processes and debates. However, these internal processes are less frequently considered by the expectations literature.

Another important feature of the reconfiguration of expectations is that, even when we are addressing the events that took place in one specific country context, it is necessary to take into consideration that broader context where the trajectory of the technologies evolve. In the case analysed, these effects were identified at several levels. For instance, the reconfiguration of expectations encompassed the results of aggregation activities taking place at "global niche level" enacted in international networks and supranational institutions, adjusting them to the country context (namely in what concerns the reframing to broader policy goals). The ability to conduct innovation activities by actors that depend largely on external resources relied on the diverse behaviour of policy makers in different countries and at supranational governance levels. The changes in attitude of policy makers at country level towards the emerging system were also partly influenced by policy decisions at these supranational levels, as well as by the credibility that an endorsement by international organisations and reputed individuals afforded to the renewed expectations voiced by local system actors. Thus recovery of policy support at country level is a process that needs to be considered also at this broader level.

This analysis was conducted on particular system in one particular context and thus not necessarily generalizable, since it is likely to be influenced by the specificities of that context. However the analysis permitted to test the usefulness of the framework developed and produced some insights that we believe to be relevant to gain a better understanding of the interactive processes through which system actors restore policy support after disappointment and bring about recovery.

Overall this research adds to the socio-technical transitions literature, by contributing to a better understanding of the development trajectories of radically new technologies that can bring about major transformations, and particularly to the comprehension of a less well understood step of these trajectories – the process of recovery after hype and disappointment.

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