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Seeking Private Industry Involvement in European Union R&D Collaboration: The Example of the Joint Technology Initiative Fuel Cells and Hydrogen

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Abstract

Public-Private Innovation Partnerships are increasingly used by the EU to address societal and environmental long-term policy goals, but also as an economic recovery tool directly supporting research in marketable technological innovations in a Europe recovering from economic crisis. These partnerships and joint technology initiatives rely heavily on private industry input and often have been initiated under the leadership of industrial research interests. One of the earliest such collaborations, the European Joint Technology Initiative *Fuel Cells and Hydrogen*. This paper tracks this initiative's origin, sheds light onto the early stages of policy network formation and examines the consequences of early policy network membership for policy success. It does so by examining three major early policy players in this process that are revisited ten years later, based on empirical evidence of data on funding beneficiaries and qualitative research interviews with actors involved in the joint technology initiative. It will show that a research organisation with its role as central knowledge-broker has been the most successful actor in this policy. While examining to what extent a core of influential network members from both industry and research have managed to maintain central positions throughout the entire process of setting up the technology initiative, the paper discovers that such privileged network positions did not automatically result in policy-success in terms of attracted EU research funding.

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Introduction

Measuring the performance of actors in European policy networks is an often attempted, but also illusive pursuit. Quantifying objectives and benefits reaped often poses problems in analysing regulative policy making. Having created a distributive policy through the use of policy networks, the European Union innovation public-private partnerships lend themselves for a way around this problem, by introducing a quantitative measure of policy-making success: the amount of research funding awarded to early policy makers of the policy-drafting process in a specific European Union innovation funding partnership. This paper will focus on the European Fuel Cell and Hydrogen Joint Technology Initiative (FCH JTI) from 2002 to 2013 and will explore the success, or lack thereof, of certain policy actors from research organisations and private industry in benefitting from a resulting policy. The central question therefore will be: How has early involvement in the policy making process leading up to the Joint Technology Initiative translated into successfully claiming funds from this science funding policy? It will show how early network membership can have an impact on later policy benefit by closely examining three independent actors within the FCH JTI.

Since the 1990s the study of networks of organized interests and their role in policy-making has enjoyed an ever-increasing academic popularity in the field of public administration, fuelled by the influential works of Bernd Marin and Renate Mayntz (1991), Jan Kooiman (1993) and Fritz Scharpf (1993, 1994) and many others. The vast literature that followed is plagued by a multitude of definitions of the concept of 'networks' (Sørensen & Torfing, 2006: 138), further complicated by the question about the static/fluid characteristics of policy networks within changing policy environments (Nunan, 1999). The study of policy networks is motivated by the realisation that the policy process is no longer so hierarchical and under the complete control of government, but rather "subject to negotiations between a wide range of public, semi-public and private actors" (Sørensen & Torfing, 2006: 3).

To date, no attempt has been made to examine the influence of such political networks on European Union research and innovation policy on a transnational European scale. While this might be down to the relative novelty of large scale, coordinated EU innovation funding policies, there is a body of academic literature in the fields of regional studies, management and research policy on the role and functioning of innovation and research networks on regional and national levels. Such efforts often focus on "identifying the best performing relational

architecture in innovation and innovation diffusion processes" (Bellandi & Caloffi, 2010: 71). One such application of network analysis on innovation networks examined federally funded innovation networks in a small region of eastern Germany, which discovered the crucial and central role of public research organisations, performing the role of "knowledge-brokers" within the innovation network (Kauffeld-Monz & Fritsch, 2013: 679). This paper will examine whether such a central position of public research organisations may also apply to more formalized innovation networks on the European level and whether the role of being a knowledge broker plays a part in the success of some research institutions in the first phase of the Joint Technology Initiative.

On the transnational European level Protogerou et al. (2013) have applied a network analysis methodology to the development and dynamics of research linkages and knowledge exchange in EU funded research networks in the information and communication technologies (ICT) sector over a period of twelve years. The authors discovered that the examined network was "dense, pervasive and robust" from the beginning on and that inter-connectivity between members strengthened noticeably over the years. The authors also demonstrated that the network was "dependent on a core of central actors" of large industry players and influential universities and research institutions, while over the years of network development, a few small to medium sized enterprises acquired equally important network positions. (Protogerou et al., 2013: 587) While this research did not deal with innovation policy networks, but rather with EU supported networks of innovators, a core of central players is likely to also exist in the policy networks involved in innovation policy making. After all, the FCH JTI itself is both, policy-making and innovation generating. This paper will look for these central actors of the HLG and how central they remained over the following 10 years, revisiting the resulting JTI after it's first phase of funding research concluded in 2013.

This paper represents a part of my PhD research dealing with the role of expert networks in the European Union's Public-Private Innovation Partnerships which come in two distinct forms: Joint Technology Initiatives like the JTI FCH, of which there are currently six, and a newer generation of contractual public-private innovation partnership, eight of which exist today. These twelve partnerships have to date not been examined by academics dealing with European politics and policy making. Although there have been numerous attempts to scientifically examine networks in innovation, as mentioned above, the more general question about the political processes that spawn networks of public and private research and innovation collaboration on the European level are academically overlooked. Historical perspectives on the formation and influence of policy networks in the fields of research and innovation policy

in the EU are also virtually non-existent. This limits the relevance of the academic literature on innovation networks' to my PhD project. The examined literature too often focuses on questions about the scope and effectiveness of innovation collaboration, the processes within innovation networks and on attempts to measure innovation network outcomes. But the questions of *how* and *why* policy networks of organized public, private and semi-public political interests inform and influence the creation of collaborative innovation networks like the European Innovation Public Private Partnerships are left largely unexplored. It is questions about these political processes that my PhD project aims to address, thus filling a lacuna in the field.

While measuring performance and results of policy network involvement in the EU focused policy-network analysis literature is an illusive, yet often attempted pursuit, the nature of the FCH JTI as a public private partnership that provides direct funding allows for a quantifiable method of, at least in part, assessing the success of members of the early stages of network formation in achieving policy or funding advantages for themselves. This is not to say that organisations involved at the earliest stages of developing a European fuel cell and hydrogen research policy would have in any way rigged the developed system in their own favour. But a more intimate knowledge of the processes and initial motivating ideas, going back further than that of other member organisations that may have joined the later forms of networks arising in this policy area, may have been beneficial in guiding applications for funding from the resulting policy instrument. More established personal professional networks of individuals involved in the early HLG, coupled to sustained engagement in the policy-making process may also have played a role in succeeding to attract funding from the JTI. It is further possible that membership in the later established governing board of the JTI – which is the legal entity deciding on the projects to be published as calls for tender – could have played a major role in later funding success. This paper will follow the public document trail the HLG and the following EU expert networks working on EU FCH research policy have left behind up to 2013 and specifically will look at the beneficiary data for funded research projects. It will furthermore integrate interview data that has been gathered in line with my PhD research with personnel involved in the HLG FCH and the FCH JTI, to supplement the quantitative data with information about the importance of certain actors at the stages of policy development. After giving a brief historic overview of the topic at hand, the paper will focus on three individual organisations that have been involved in the FCH JTI as early policy advisers. It will will examine how these three organisations have fared in the later resulting research funding policy.

The paper will finally provide some explanations why some of these actors have succeeded in attracting more research funding than others.

Historic Context of a Coordinated European Hydrogen Research Funding Policy

The historical development of the FCH JTI and the different stages in which it developed are crucial to understand how certain actors have managed to benefit from the Joint Technology Initiative. The following four paragraphs will provide a very brief historic overview of the processes and stages of policy development that eventually led to the creation of the initiative. This will allow to track the membership and role of the three organisations closely examined by this paper throughout the entire policy process.

Hydrogen and fuel cell technology has long been lauded as a shining beacon in the global fight against man-made climate change. Faced with rising CO2 emissions due to rising energy needs and finite fossil fuel reserves, the use of the most abundant element in the universe – hydrogen – as an energy carrier looks like a logical choice. But hydrogen and fuel cells have struggled over decades to reach a market-ready level of maturity and European research in these technologies was fragmented, under-funded and largely governmentally driven. In the early 2000s interest in the technology entered the crosshairs of the European Commission (EC) as a substantial factor in developing cleaner transport and power generation. At this point in time, the United States and Japan were the world leaders in research in this technology. Ten years after signing the Kyoto protocol, the EC began assembling a high level group (HLG) of experts in October 2002, charged with coming up with a coherent strategy for supporting the technology on the European level. Although this group was comprised of 19 stakeholders representing research, industry, governments and an end-user association, the overwhelming majority of stakeholders came from private industry, making up 13/19 in the composition of the HLG. With market-readiness of fuel cell and hydrogen technology in mind, this composition of the HLG was not a coincidence. In the EU logic only industrial involvement in the drafting of European fuel cell and hydrogen policy and new EU support structures could lead to a market driven proliferation of the technology.

The 16-page report that concluded the HLG's work made a series of five key recommendations for action on the European level. Next to a cohesive political framework, a European strategic research agenda, European deployment strategies and a guiding European roadmap for the technology, the report also recommended a European hydrogen and fuel cell technology partnership governed by an advisory council that would "provide advice, stimulate initiatives and monitor progress" (HLG for Hydrogen and Fuel Cells, 2003: 2). Endorsed by

the EC later that year the newly established advisory council initiated the formation of the *European Hydrogen and Fuel Cell Technology Platform* which held a first general assembly in January 2004. Composed of around 400 members, the platform had a very broad membership of the previous members of the HLG and the advisory council, member state mirror groups, civil society, financial institutions, EU institutions and coordinators of EU, national and regional projects and initiatives. (European Commission, 2004: 33) From here on out, the European Technology Platform (ETP) set off to achieve the recommended actions of the HLG, which after three years of work, crystalized into a formalized form of public-private research partnership on the European level: the *Joint Technology Initiative* (JTI) *for Fuel Cells and Hydrogen.*

The JTI's aim was to fund research and demonstration projects with a financial risk-sharing arrangement between private industry and the EC's research funding capacities, most notably the Seventh Framework Programme (FP7) of the European Union set to run from 2007 to 2013. As the funding was made available through the standard funding platform, anyone eligible for EU science funding could form a research consortium, write a funding application and be fairly considered in a peer-reviewed process of evaluation. Within FP7, the FCH JTI paid out over € 450 mill. in research funding from 2008-2013. This represents a little under one percent of the entire FP7 research funding budget of € 50 billion for that period. The European Council Regulation No 521/2008 established a legal entity, responsible for achieving the aims of the JTI (European Council, 2008). This Joint Undertaking (JU) was composed of representatives of industry, research and the EC, which made up the JU's governing board. The idea behind this JTI was to prepare and agree on research project calls for tender that would be published through the existing research funding platform of the EU's science Framework Programme. The JU therefore effectively was the gatekeeper and decision-maker on which research and demonstration projects would receive funding support from the EU through the JTI and which would not.

After a little over five years of work, a coordinated EU policy on supporting and guiding research in fuel cells and hydrogen was now in place. What had started with a strategy developed by a high level group of 19 organisations, was now a formalized partnership under the guidance of over 120 industry and research partners that funded 130 projects involving 430 individual funding beneficiaries from 2008 to 2013. The sudden increase in funding and coordination begs a question however: How have the 19 organisations of the initial High Level Group fared ten years after they began their work drafting a cohesive strategy for FCH research and support on the European level? Who were the leading beneficiaries of the FCH JTI in its

first incarnation during the Seventh Framework Programme and, more pertinently to this paper: Why might some of the original 19 organisations have attracted significantly more research funding from the honey pot of their own creation, than others have? In light of these questions, this paper will examine the top 25 beneficiaries of the FCH JTI compared to the original 19 initiators of the EU policy and strategy. The paper will furthermore explore which members of the original HLG are holding executive positions within the established JTI. It will specifically look at one public research organisation (CEA) and two major industry players (DaimlerChrysler and AirLiquide) involved in the earliest stages of this policy making process and try to find answers to the significant disparity of success in being awarded funding from the JTI.

The Winners and Losers in Awarded Research Funding

As stated in the introduction, the HLG that met in 2002 and wrote the influential report of 2003 was composed of 19 members. Represented were four major research institutions from France, Germany, Italy and Spain, twelve major European industrial players and utility companies including, among others, *DaimlerChrysler*, *Solvay*, *Siemens*, *AirLiquide*, and *Renault*, one small to medium sized enterprise from Belgium, the *International Organisation for Public Transport Authorities and Operators*, and – perhaps surprisingly – representatives from the Icelandic Parliament. (see Table 1 for full list of members) When the members of the HLG are compared with the top 25 beneficiaries of the FCH 1 JTI (2007-2013), there are only two overlapping organisations: The *French Alternative Energies and Atomic Energy Commission* (CEA), a public research and research-coordinating body of the French government, and *AirLiquide*, a major French multinational chemical company and important producer of hydrogen-gas. These two actors together lead the list of beneficiaries, having collectively almost attracted 7 % of all funding from the JTI – a JTI that overall contributed to the research of 430 organisations.

The case of these two French actors is an interesting one, as their relationship goes back in time before the EU had the idea of coordinating and extending its fuel cell and hydrogen research policy in 2002. Since the 1990s PSA Peugeot Citroen led several research programmes for advancing the technology, research projects in which both CEA and AirLiquide –among others - were partners (Weaver, 2010: 45). Furthermore both of these players had previously received funding from the EU's 5th Framework Programme (1998-2002) for research in the area of FCH. Both organisations therefore had previous connections and also had experience in coordinated efforts of technology research in the field. Coupled to the generally close

relationship between the French state, its research centres and industries, an image emerges of two strong research and industry players, with previous successes in applying to EU research funding, which seem to have managed to transfer their experience in research-policy making and research coordination on the French national level to the new initiatives on the EU level.

With € 19.7 mill. in received JTI funding, the *French Alternative Energies and Atomic Energy Commission* (CEA) is the clear winner in the scramble for funding up to 2013, followed by € 11.31 mill. awarded to *AirLiquide* (Lucchese, 2015). But it is not only in terms of awarded funding, that these two French players have managed to succeed in the FCH policy process. When the JTI was being prepared by the European FCH Technology platform from 2003-2007, the stakeholders organized themselves into three main groups representing research institutes, industry players and the EC. These three groups also later supplied the members of the governing board of the FCH JTI, six of which came from the industry group (*Hydrogen Europe*), three from different EC DGs involved and one from the group of research organisations (*N.ERGHY*). The representative of this research grouping in the JTI was CEA. It should also be noted that the chair of the JTI's governing board was provided by the industry grouping, and ended up to be none other than the representative from *AirLiquide*. These two French players have therefore managed to maintain very central roles across the development of the policy network that eventually led to the formalized technology initiative, holding on the important coordinative and executive functions throughout.

As is often the case with HLGs working for the EC, the HLG was supplemented with a lower level working group of the same organisations, named the *Sherpa Group,* in the Commission's common vernacular. While the HLG was indeed, as the name suggested, a group of leading figures of the organisations represented – usually the director or CEO – the Sherpa Group consisted of the true experts in the field of hydrogen and fuel cells in their respective organisations. Much of the strategy and assessment of the needs of a European fuel cell and hydrogen research policy was developed by the Sherpas. It was the Sherpa for CEA, Paul Lucchese who later became the president for N.ERGHY and representative for this research grouping at the ETP and later JTI. He has remained in this post until today. This long term and stable commitment of resources, without major personnel changes may have played a significant role in establishing CEA as an important and central player in the FCH JTI, as over the years CEA's Paul Lucchese both developed increased personal experience in navigating the policy process, but also by simply building and maintaining his personal professional network within the ETP and later JTI.

The third HLG member to be closely examined by this paper is the German multinational DaimlerChrysler. Similarly to CEA and AirLiquide, Daimler's representatives continuously held key positions in the development of the JTI and even were among the few partners who had successfully received EU research funding during the 5th Framework Programme, before the EC initiated the policy process for developing FCH. Similarly to CEA and AirLiquide, DaimlerChrysler also held key positions throughout this process. In the developmental stages, the company held the chair position for the FCH technology platform and later held one of the six industry grouping chairs on the FCH JTI's governing board. In terms of network position and involvement, DaimlerChrysler held equally important positions as the two French players. What it did not manage, however, was to achieve a similar level of success in being awarded research funding. With € 3.82 mill. Daimler did not make it into the top 25 beneficiaries of the FCH JTI at the end of 2013. Early policy involvement alone could not have been a determining factor for success, when it came to receiving public funding for R&I.

As the FCH JTI's main objective was to involve European industry in the coordinated research efforts, the overall distribution of funding until 2013 in fact shows that private players and industry as a group managed to attract 57.7% of all funding with a majority this money going to only four countries: Germany, France, Italy and the UK. With the exception of AirLiquide however, none of the original HLG industry players managed to be in the top 20 beneficiaries of the JTI. In fact, only 4 of the 13 private HLG members can be found on the extended list of the top 150 beneficiaries, while 3 of the 4 HLG research organisations represented on this extended list. Figure 4 of the 20 most successful beneficiaries also shows that 7 of the 20 organisations were small to medium sized enterprises (SME), partners, who were not involved at early policy network stages at all. When we consider the question of how membership in the earliest policy-network – in this case the HLG – might be reflected in final financial benefit ten years later, it seems that research organisations managed to more successfully benefit from their early involvement in the HLG. DaimlerChrysler, which had a central role in the policy development process did not make enough use of the resulting policy of funding opportunities. During research interviews with involved research and EC officials for my wider PhD project, a certain level of dismay with the German multi-national was expressed on several occasions. Being a high hopeful in the technology in the early stages, the company was seen has having moved too slowly, allowing American and Japanese companies to increase their lead in making the technology market-ready, according to a DG Energy representative in the JTI. This tangible disappointment with the company may have been

aggravated by Daimler's central position throughout the policy making process, as this seem to have sowed the expectation of stronger participation and collaboration in research through the JTI.

Knowledge-Brokers and Central Actors?

Reflecting on the roles of major research organisations in innovation networks in the literature, the case of CEA as a central coordinator throughout the development of a European FCH policy begs the question whether research organisations have similar "knowledge-broker" roles on the transnational European level, as described by Kauffeld-Monz & Fritsch (2013) on a small German regional level. The continued commitment and central position of CEA in the entire policy process, from early policy entrepreneur in the HLG, to representative of all research partners in the technology platform and later research representative of the JTI's governing board, make CEA one of the most influential and important partner organisations in the FCH JTI. It can not however be conclusively said that CEA's important position was the key determining factor for later success in attracting research funding from the JTI. The relative success of some research organisations in attracting funding is more likely to stem from the fact that fuel cell and hydrogen technology still required significant fundamental research in the first stage of the JTI. Being the exclusive domain of public research, fundamental science rarely catches the eye of private research actors, as its results are too far removed from marketable technologies. As the rules of the JTI required equal funding levels for all funded projects by partner organisations, it is not surprising that industry research was not prepared to pay for research projects with little prospect of monetization.

But even here, private industry does not equal private industry. Comparing the cases of AirLiquide, a chemical company with a focus on gas production and DaimlerChrysler, a car manufacturer representing the final market ready stage of FCH technology, that a private player whose main business is closer to fundamental science can still be highly successful in attracting research funding. The success in attracting funding therefore may be much closer correlated to what a particular organisation does as its main occupation than to continued influence in the policy making process leading up to the final funding policy. It is also true that public research institutions have by definition more experience in dealing with public funding applications on national and European levels, since such organisations are usually completely publicly funded, or even distribute research funding from the European level on national and regional levels.

Revisiting Protogerou et al.'s (2013) work on the development and evolution of EU funded innovation networks in the ICT sector, certain parallels can be found with the

development of FCH JTI. There has indeed been a core of central drivers of the process that have been present throughout and, as discovered by the study on the ICT sector, these central players have been large industry players and technology and research leaders. As central players, organisations like CEA, AirLiquide or DaimlerChrysler have remained in in important positions within the networks of the JTI and carry much of the administrative work-load of the JTI, enhancing their network connections continuously. In terms of positioning themselves in the network of the JTI, all three organisations examined more closely by this paper have been successful. But this success did not automatically translate into successful funding applications. A second observation made by Protogerou et al. was the eventual emergence of central and important SMEs in the innovation networks examined (2013). The fact that 7/20 of the top beneficiaries of the FCH JTI are SME's is another parallel to draw with the previous results, not because success in applying to JTI funding equates to network centrality/position, but because of the reasons SME's manage to advance at later stages: "their significant role in the creation and diffusion of knowledge" (2013: 587). The success of SMEs in the first stage of the FCH JTI therefore is less surprising than one would assume, considering that SME might have more difficulties in the long-term planning required to participate in research collaborations and less financial security to do so, than large industry players.

Conclusions and Future Outlook for the FCH JTI

The questions about the success of individual participants in the EU's Fuel Cell and Hydrogen Joint Technology Initiative therefore should be asked in two parts: How did network position evolve for individual players involved in the process, and who benefitted most from participating in the JTI in terms of research funding. Although there seems to be a connection between early network membership and later success in funding applications, early memberships does not necessarily translate into funding success, as the case of DaimlerChrysler shows. This poses the question why companies would commit the resources to participate in the laborious task of policy making – particularly in the form of a formalized and complex EU public-private partnership – if the resulting policy of industrial research funding is not taken full advantage of. This may be an indication that wanting to play an influential role on policymaking can either be a motivation in itself, or that resulting policies after a long policy-making process might not always be to some actors' liking. The question why DaimlerChrysler, but also other large industry players from the HLG did not receive more funding is one my research will explore further. It can be certainly said that early policy network membership can have significant advantages later on. In the FCH JTI, specifically

dealing with a technology in its infancy, might by its very nature be pre-disposed towards benefitting organisations carrying out fundamental research or having a strong vested business interest in basic technological advances in a technology.

An interesting question posed by the results of this paper will be the actions central members of the EU's FCH collaboration could take to improve their later chances in receiving funding through the JTI. Could successful actors like CEA and AirLiquide push and lobby for projects within the JTI's governing board, which would be most likely to result in successful applications for their organisations? While the official documents follow a rhetoric of developing a coherent strategy towards the advancement of the technologies to market-readiness, hidden agendas of active participants in the JTI may indeed also have influence on the drafting of project calls. The successful actors like CEA and AirLiquide could in theory have promoted projects geared towards their own success. While empirical proof for this possibility could be hard to come by, it is certainly true that these two successful actors had an idea of the upcoming project calls, long before anyone else did. This could easily have given researchers in their respective organisations more time to prepare research funding applications. Generally, the way individual actors can benefit from different levels of involvement, at different stages of the policy-making process and the determinants for influence on this process, will be key questions for my PhD project to answer.

With these questions my analysis of the development of FCH JTI, and other *Joint Technology Initiatives* and contractual *Public Private Partnerships* in innovation, returns to the larger issues of the influence and workings of policy networks in the European union in general. While the JTI FCH falls clearly under the topic of democratic network governance, the short list of initial HLG members indicates certain neo-corporatist qualities of networks composed of a small number of privileged early members. How these members can influence the development of networks towards more pluralist, later forms with wide-ranging membership, is of key concern to a European Union that is indeed completely dependent on the work of policy networks of industry/business and research representatives (Coen & Richardson, 2009: 151). Indeed, the notion of 'closed governance', as a neo-corporatist view would suggest, would be an intrinsically schizophrenic notion (Sørensen, E. & J. Torfing, 2006: 112). While the vast literature on policy networks has sprouted many different definitions and forms of policy networks, from issue networks, to policy communities, with more or less fluid membership, different levels of influence, it is to be seen how transnational European networks in innovation policy might have different processes and characteristics compared with the wealth of governance networks examined by the academic literature in the past two decades.

As formalized legal entities with executive powers in regards to the distribution of EU research funding, the EU's public private innovation partnerships, such as the FCH JTI, indeed represent a new form of policy network. As they legally bind together Europe's epistemic and industrial communities and bestow powers of distributing significant funding to the network, these public-private partnerships go decisively further than traditional networks in regulative governance processes.

As the use of European public-private innovation partnerships increases, answering the questions regarding the typology of networks involved, the central actors in these networks and how they can influence policy for their own regulative and redistributive benefit, are also becoming increasingly important. The involvement of large private stakeholders in European innovation funding policy also poses serious questions about the direction the EU's research and innovation policy is headed, most notably about the extent to which one could call these funding policies a subsidization of European industry under threat of global competition. As such, the topic of the EU public-private innovation partnerships is also a story of the failure of European industry and private innovators, incapable of achieving the level of innovation and R&D investment necessary to secure Europe's position as a leading light in global high-tech and innovation. In this context, the EU's public private innovation partnerships also fit into the academic discussion of the role of governments in the creation of marketable scientific innovations globally and specifically in the member-states of the European Union.

The European Commission, in the meantime, is extending its supranational governmental influence in producing European innovative progress with a dozen of new public-private innovation partnerships und the current funding phase of *Horizon2020*. Since this phase started in 2014, the second phase of the FCH JTI has commenced under the EU's new science and innovation framework programme. Until 2020, this second phase is hoped to deliver on the market readiness of FCH technology and stronger involvement of large industry and had its budget extended to € 1.33 billion. With this tripling of funding the JTI is currently being extended to involve the energy industry in a stronger way, moving away from the transport focus of the FCH 1 JTI discussed by this paper. According to a high-ranking EC official, who did not want to be named, integrating a slow-moving industry like the energy business into an innovation oriented public-private partnership will pose foreseeable problems. Particularly as this is an industry that plans in 20 year steps and is considered somewhat inflexible. What may follow is increased conflict or competition for funding on the governing board of the JTI, as demands towards research requirements may drift apart. Whether this will

accelerate Europe's attempts to catch up with the global competition in FCH technology, seems doubtful.

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Annex

Name of Organisation	Type of Organisation
ENEA	Research
CIEMAT	Research
FZ Jülich	Research
CEA	Research
Rolls-Royce	Industry
Nuvera	Industry
Johnson Matthey	Industry
Solvay	Industry
Siemens Westinghouse	Industry
Ballard Power Systems	Industry
AirLiquide	Industry
Vandenborre Technologies	SME
Renault	Industry
DaimlerChrysler	Industry
Shell	Industry
Norsk Hydro	Industry
Sydkcraft	Industry
Icelandic Parliament	Governmental
International Organisation for Public Transport Authorities and Operators (UITP)	International end-user association

Table 1. Composition of the High Level Group for Fuel Cell and Hydrogen Technology 2002-2003. (EC, 2003)

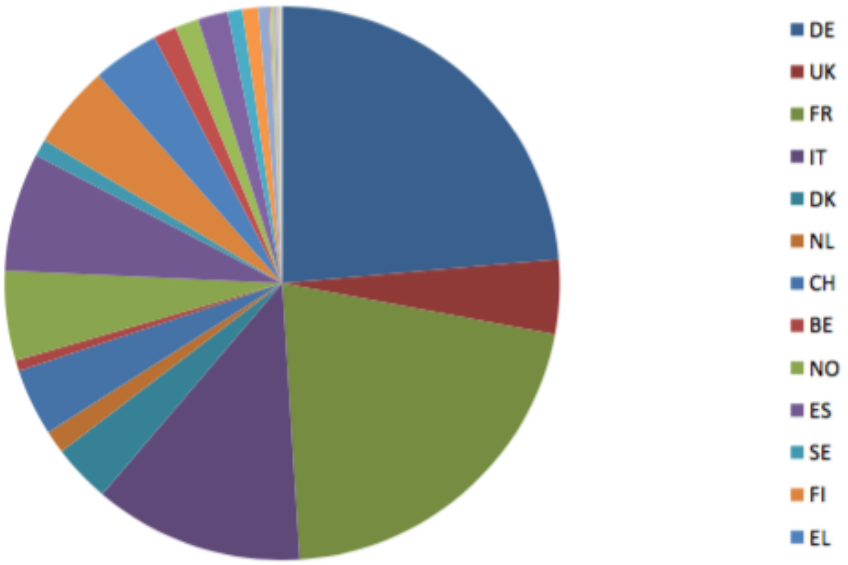

Figure 1. Distribution of JTI Funding going to research organisations across countries (Total € 152 mill.) (Lucchese, 2015)

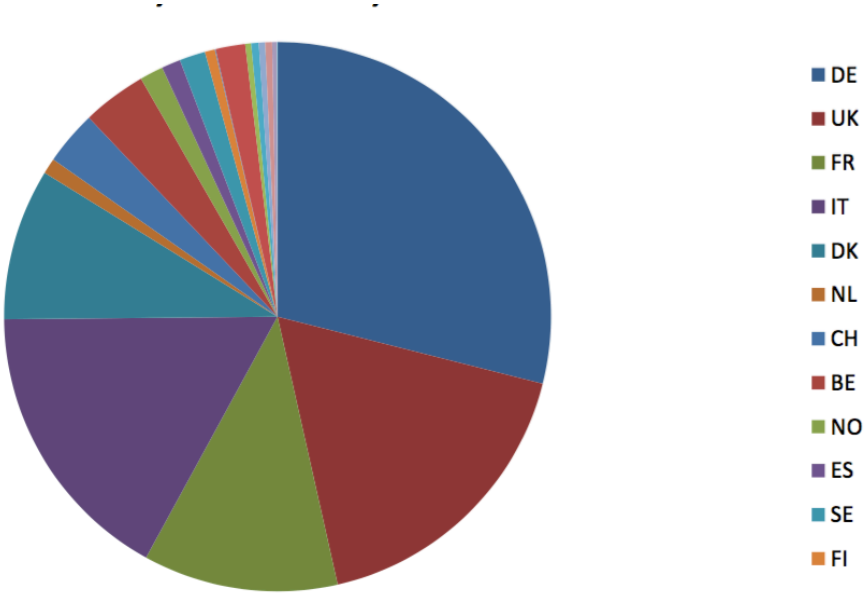

Figure 2. Distribution of JTI Funding going to Industry across countries (Total € 144 mill.) (Lucchese, 2015)

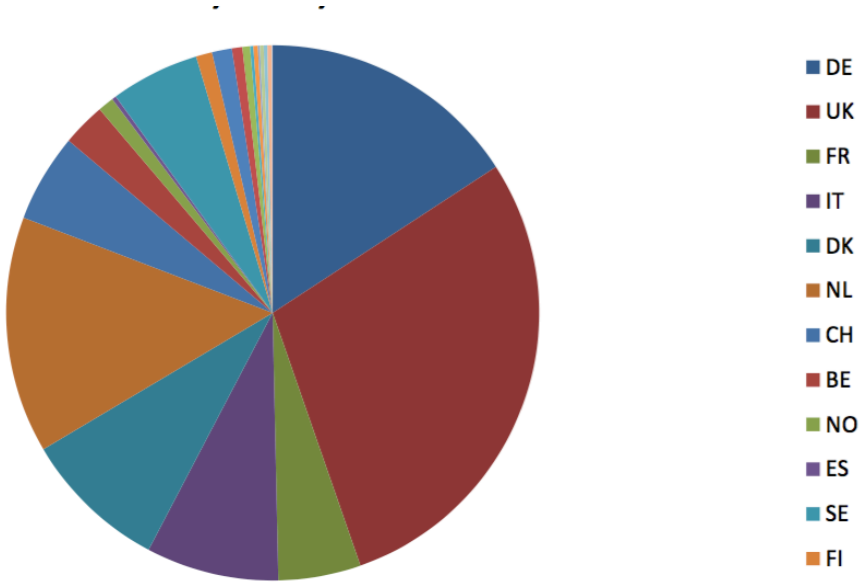

Figure 3. Distribution of JTI Funding going to Small to Medium Sized Enterprises across countries (Total € 116 mill.) (Lucchese, 2015)

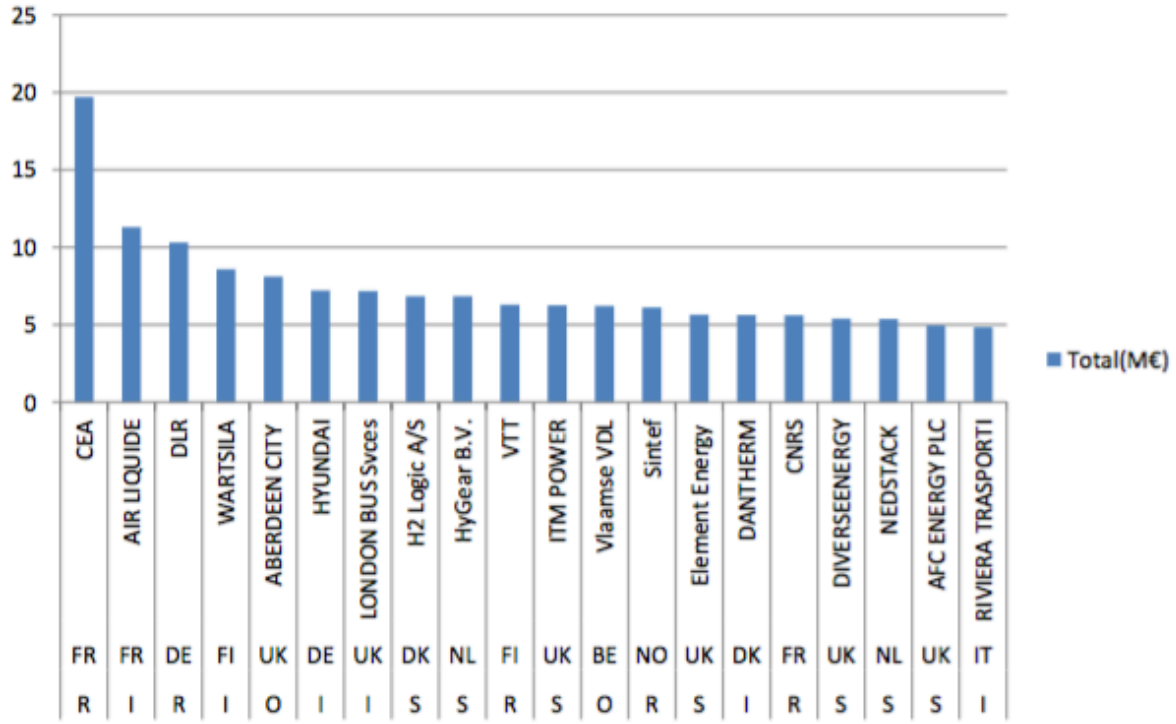

Figure 4. Top 20 Funding Beneficiaries of the FCH JTI in million €. (Lucchese, 2015)